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Cambridge Industrial and Commercial Series

General Editor: G. F. Bosworth, F.R.G.S.

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FACTORIES AND GREAT INDUSTRIES

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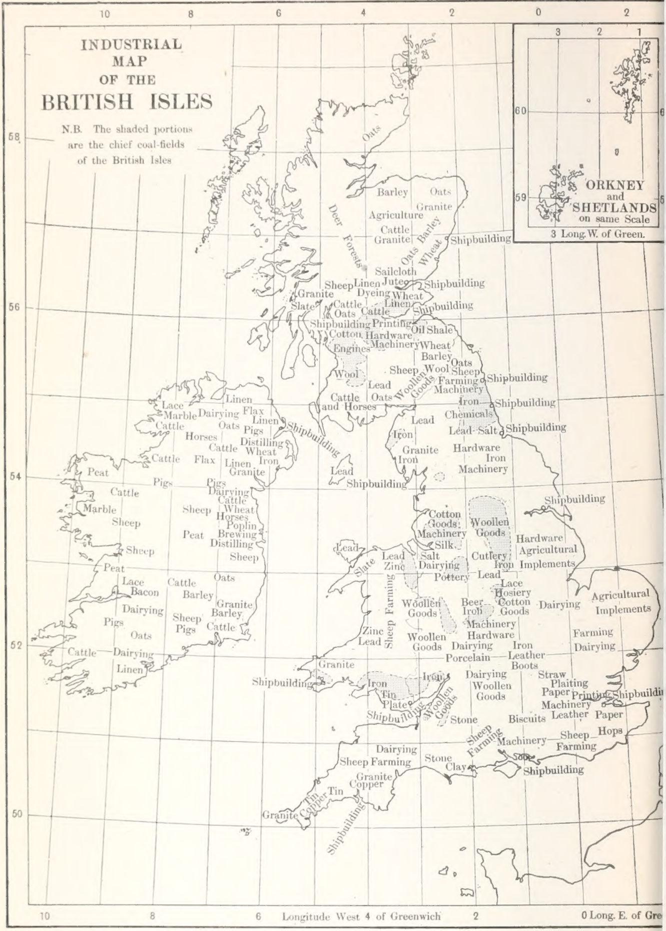
INDUSTRIAL MAP OF THE BRITISH ISLES
N.B. The shaded portions are the chief coal-fields of the British Isles
ORKNEY and SHETLANDS on same Scale
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Deer Forests
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Linen
Jute
Shipbuilding
Granite
Dyeing
Wheat
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Cattle
Linen
Shipbuilding
Oats
Cattle
Shipbuilding
Printing
Oil Shale
Cotton
Hardware
Engines
Machinery
Wheat
Barley
Oats
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Granite
Shipbuilding

FACTORIES AND GREAT INDUSTRIES

WITH SOME ACCOUNT OF
TRADE UNIONS, OLD AGE PENSIONS
STATE INSURANCE
THE RELIEF OF DISTRESS
HOSPITALS

by

F. A. FARRAR, B.A., B.Sc.

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1916

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GENERAL PREFACE

THE books in this Series deal with the industrial and commercial condition of our country. Of the importance of the subject there can be no doubt, for it is the story of the material side of the life of a great nation. British agriculture is the most enterprising in the world; British manufactures, both textile and hardware, are famed in all parts of the globe; British ships are on every sea and carry for other nations as well as for ourselves; and Britain, through the Banks and Exchanges of London, is the centre of the money market of the world.

It has been well said that material needs cannot be neglected or forgotten with impunity in this world. Just as a man must have bread to eat if he wishes to enjoy life, so a nation needs material prosperity if it is to be of real influence in the world. Industrial and commercial prosperity does not, in itself, constitute greatness, but it is a condition without which national greatness is impossible. Hence, the story of the industrial and commercial condition of Britain is worth telling to our school children, not only that they may rejoice in our country's progress, but, also, that they may realise the responsibilities borne by the citizens of the first of all nations.

G. F. B.

EDITOR'S NOTE

THIS book gives a popular account of the textile industries that are carried on in our great manufacturing towns, and has some chapters on printing, and on the making of paper, leather, and straw hats. The Industrial Revolution of the eighteenth century and the evolution of the present highly organised factory system in the chief industrial centres of Britain are historically considered, and special attention is given to the movements of manufactures, such as the smelting of iron from Sussex to the Midlands and the North. The later chapters deal with such important industrial topics as the government inspection of factories and mines, with trade unions, and with the relations between masters and men. The care of the aged and infirm, the institution of government old-age pensions and insurance, and the development of hospitals and dispensaries come within the scope of this book, for they are subjects that should be understood by all school children—the future citizens of our country.

Teachers and students who wish to study in greater detail any part of the Industrial and Commercial History are advised to use Dr Cunningham's *Growth of English Industry and Commerce*, published by the Cambridge University Press. There they will find full and accurate references to a large number of authorities on all branches of this subject.

G. F. B.

October, 1915

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1. THE INDUSTRIAL REVOLUTION

Until well into the eighteenth century, England was mainly an agricultural country, with a small population, and raising without difficulty a supply of food sufficient for its people. It had a few large cities and towns, especially seaports, but most of the towns were small compared with present-day standards. Small country towns and thriving villages, with the ancestral homes of the nobility and gentry, were the chief features of the countryside.

There were, indeed, important manufactures, and even an export trade in manufactured articles, but these, with the exception of wool, were insignificant compared with the industries of to-day. What manufacturing was done was largely carried on, especially in the case of spinning and weaving, in the homes of the people, who were also occupied, as a rule, on the land. Their machinery and implements differed little from those used by their forefathers for centuries.

The wealthy class, except in the cities, was chiefly composed of landowners. Then, and at an even later time, travelling was done by road—the roads being in a shocking state in bad weather—and was slow, dangerous, and expensive. Canals, railways, and steamship, were unknown. Wood was the chief fuel.

By the end of George III's reign an astonishing change had come about. England, with southern Scotland, had become a great manufacturing country—the workshop of the world. A class of wealthy manufacturers was springing up. The cotton industry had come into being and was rapidly growing, while in this, as in the woollen and other textile trades, new and ingenious machinery was being used, driven first by water-power, later by steam.

Coal had largely replaced wood as fuel in the home, and was also being used in furnaces. Roads were vastly improved, canals were being dug all over the country; steamships were already in use; cotton and woollen, iron and steel goods were being sent all over the world. The population had grown to such an extent that it had become impossible to produce sufficient corn at home, and large quantities were being imported. It was largely the new stream of industrial wealth that enabled Britain to stand the tremendous strain of the conflict with Napoleon.

This remarkable change is so striking that it is known as the Industrial Revolution, and it is noteworthy that during the same period our oldest industry, agriculture, underwent a change almost equally striking. Small farms were swallowed up in large farms, commons were enclosed, fresh capital was being put into farming, better and more scientific methods were being used in the raising of crops, sheep, and cattle. This part of the transformation was largely due to the rousing of the national mind by the industrial revolution.

But the question naturally arises: How are we to account for the industrial revolution? Apart from secondary causes which helped to bring about the change, the answer is to be found in the invention of the steam-engine and of improved machinery, and the application of the former as a motive power. And it must be borne in mind that the wonderful results of the continuous efforts to devise mechanical improvements have developed our industrial life to an extent undreamed of a hundred years ago.

It is interesting to notice that the steam-engine was at first regarded simply as a means of pumping water, especially from mines. But the invention by James Watt, in 1765, of the steam-engine in the modern sense of the term produced a means of applying steam-power directly to machinery. Previously, the piston was driven forward by steam introduced into the cylinder, the steam was condensed, and the partial vacuum produced enabled the pressure of the air to drive the piston back. But in Watt's engine, which was far more powerful and far less costly to work, the piston was driven both ways by the expansive power of steam.

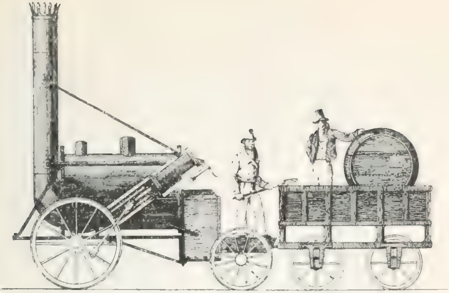
Naturally, the new engine would have remained much less useful than it is had it not been for the invention of machinery, capable of greatly multiplying production, to which it could profitably be applied. What some of these inventions were, and what a revolution they worked in our industries, we shall see later. Meanwhile, we may note some of the changes in our national life produced by them.

In the first place, they gradually, and in some directions completely, destroyed what is known as the "domestic system," by which families carried on in their own homes certain manufacturing processes, especially spinning and weaving, and introduced in its place the "factory system," of which more will be said presently. Then, again, the setting up and working of engines and machinery, with the necessary buildings, with the payment of weekly wages, involved the outlay of a very large amount of money. Thus Capital became a far more important factor in the national life than ever before.

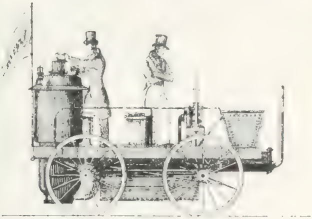
The expense of getting raw materials to the factories and finished goods to their market was a very serious item, and great efforts were made, with striking results, to reduce this. The roads were improved out of all knowledge; canals were greatly extended; and then came far more important developments. The opening of the first railway (Manchester and Liverpool) in 1829 marked a new era, and the improvement and extension of railway and steamship traffic since have revolutionised the commerce of the world.

Certain industries had already become specially established in certain districts for various reasons—wool, for example, in areas specially suitable for sheep-rearing. But as the factory system developed, abundant water-power provided by rivers and streams (as in the West Riding), and then coal-supply became very important considerations. Steam-power demands an abundant supply of coal, which is bulky and therefore costly in carriage, and industries naturally developed rapidly on the coalfields, which, fortunately, happen to be usually iron-fields as well.

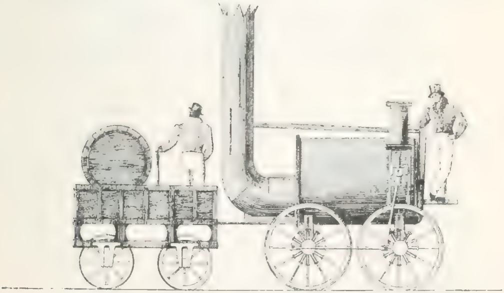
On these, especially, new towns sprang up, villages grew into great towns, towns into great cities. Some of our now vast cities, like Leeds, Glasgow, and Birmingham, had been notable towns, of far less extent, for centuries, while most of the present-day inland towns of the north were quite insignificant. The ports which serve them, like Liverpool and Hull, have prospered along with them. On the other hand, some towns and districts, as we shall see, through the absence of some advantage, especially coal,



The *Rocket* of Mr Robt. Stephenson of Newcastle



The *Novelty* of Messrs Braithwaite and Ericsson of London



The *Sans Pareil* of Mr Hackworth of Darlington

The Locomotive Steam Engines which competed for the prize of £500 offered by the Directors of the Liverpool and Manchester Railway Company necessary to modern methods, have seen their once flourishing industries dwindle away, or even perish altogether. Other results, indirect but very important, will be dealt with in later chapters.

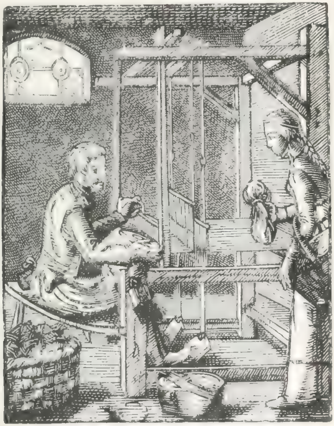
2. THE FACTORY SYSTEM

Although the factory system was the natural result of the introduction of steam-power, there had been indications of it long before. The cloth-merchants of the sixteenth century were in many cases capitalists in a small way, and kept many weavers employed, but in their own homes. Then they began increasing the number of looms on their own premises, and bringing in men to work them. One clothier at Newbury had thus 100 looms in his own house. But the workers complained, and the government of the time passed, in 1555, a Weavers' Act to put a stop to this arrangement.

The introduction of factories had both good and bad results. It certainly made possible a greatly increased production, at a greatly reduced cost. It ensured constant wages to the worker, and saved the time—perhaps a day a week—he had spent, when working on his own account, in fetching materials and getting his goods to market. It also put a stop to the stealing of material, which seems to have been a serious matter when wool, for example, was given out to be worked up at home.

But it ruined many a family which had eked out a living by spinning or weaving in addition to farming. Defoe, writing in 1727, shows vividly how the domestic system worked on the western border of Yorkshire.

He tells us: "Among the manufacturers' houses are scattered an infinite number of cottages or smaller houses, in which dwell the workmen that are employed, the women and children of whom are always busy carding and spinning, so that, no hands being unemployed, all can gain their bread, from the youngest to the most ancient. Hardly anything above four years old is insufficient to itself."



Medieval Loom

Some of these cottages may still be seen, with windows from end to end, behind which, in the olden days, stood the loom, so that the work might be done in a good light. It was bad enough when little children were made to work long hours in their own homes, but in the factories child-labour soon became a dreadful feature.

In the workhouses of the land there were thousands of children being supported by the poor-law authorities, as there are now. The authorities were glad to be relieved of the expense of keeping them, and the mill-owners were glad of a supply of cheap labour, so waggon-loads of the poor children were sent off to work in the factories. They had practically no protection from a brutal master, and in such cases their lot was indeed a hard one. Children of six years of age were compelled to work as much as fifteen hours a day, and were sometimes kept awake by beating. They had no wages, and their food and clothing were often poor and scanty.

Even for adults, and especially women, the hours of labour were far too long, and accidents frequently happened through the dangerous nature of the machinery. The conditions under which the work was carried on varied with the nature of the industry, but they were usually unhealthy, owing to dust, excessive heat, damp air, wet floors, or other causes. Yet many of the workers, through poverty, or more often through greed, sent their own very young children to the hard life of the factory.

The rapid growth of the manufacturing towns, as the factories increased in number, has been already mentioned. Unfortunately, the only object kept in view was to build houses as cheaply as possible, without regard to the welfare of those who had to live in them. The result was that they were, as a rule, small, inconvenient, ugly, huddled together in mean streets, and without gardens or other open spaces.

All these evils which have been mentioned, acting together, soon began to show their effect on the character of the population. The death-rate was dreadfully high;

far too many were weakly, stunted, or deformed in various ways, and as little attention was paid to education and other uplifting influences, thoughtful people were anxious as to what was to be the outcome of the new conditions of industrial life.

While these changes were coming about, there was a general feeling that parliament should not interfere in such matters. The idea was that the manufacturers would naturally wish to do the best they could for themselves, and the work-people, on the other hand, would be anxious to secure their own interests. Each being quite free to make a bargain, they would come to a mutual agreement fair to both parties, and the arrangement thus made would be more satisfactory than any government interference could bring about. Such interference, by people who could not be expected to know all the bearings of the subject, could only result in muddle.

This policy of *leaving things alone*, in the hope that they would right themselves in the end, held its ground for a long time, and is known as the *laissez faire* policy. But unfortunately it worked badly, for it was based on a false principle. Children, at any rate, are not in a position to make a free bargain, or a bargain of any kind, and they certainly suffered great hardship and injustice.

Nor can adults be fairly said to be in such a position when, as often happened, they had to choose between working on the terms offered by the masters, on the one hand, and starvation on the other. So the *laissez faire* policy was gradually abandoned, as we shall see in a later chapter, and government has repeatedly interfered, with the result, on the whole, that vast improvements have been made in many directions.

One more result may be mentioned here. The first point about machinery is that it enables a few workers to do what previously required a great many to accomplish. As time went on, cheapness of production and carriage enabled merchants to open up fresh markets all over the world, and trade grew to such an extent that far more workers were required than ever before, but the immediate effect, too often, was to throw a number of people out of work.

These naturally regarded machinery as an enemy, and future expansion, even if they could have foreseen it, would have offered poor consolation to them. The lives of inventors were often threatened. Bands of discontented workmen went about destroying the new machines, and riots often occurred. In one day every power-loom in Blackburn was destroyed; Nottingham was the scene of serious rioting. A workman named Ned Ludd gave his name to the Luddites, who went about in bands attacking factories and smashing machines. It was made a capital offence, and a number of those caught were hanged.

Still, it must be admitted that the factory system, though at first it had such serious drawbacks, and is even now not an unmixed good, played a great part in making Britain the greatest manufacturing and trading country in the world, and raising it to a position of wealth and power unequalled by any other nation.

3. SPINNING

The making of cloth is certainly one of the oldest industries in the world. It naturally occurred to primitive man to clothe himself, especially in cool or cold countries, in the skins of the animals he killed in the chase. But in very early times men found that they could spin the hair or wool of certain animals, and the fibres of certain plants, into threads, and by weaving these together make themselves clothing.

This discovery was made independently by many early races, as were many other discoveries. When Columbus discovered America he found the natives dressed in cotton clothing. The inhabitants of some parts of our own island were wearing woollen robes long before Caesar came; and at a still earlier age the people of India, and before them the people of China, were quite skilful in weaving cotton fabrics, while the latter also wore garments of silk.

A fibre of wool is curly and elastic, and if examined under the microscope it is found to have its surface broken by overlapping scales, or serrations. The fibre of cotton—the thin hairs attached to the seeds of the cotton plant—is flatter and less rough. In fact all natural fibres are found, under the microscope, to have their own special characters. But the fibres of all varieties used in spinning have in common the qualities of roughness and elasticity, and it is because of these qualities that they can be spun into threads, the tenacity or strength of which is due to the tiny projections of the fibres hooking into each other and making them cling together, as well as to the strength of the fibres themselves.

Present-day methods are, of course, very different from those used by primitive man, but, strange to say, the whole advance from very simple types of machines to the wonderfully complicated and delicate mechanism in use to-day, has been made in less than two centuries. In very early times a bundle of the material to be spun was placed on a stick, or distaff, which was held under the left arm of the spinner, or more usually the *spinster*, for this was in all ages until recent times a most important part of women's work.

The hands were employed in drawing out the material from the distaff at a rate sufficient to form an even thread. The thread itself was twisted, to make it firm and lasting, and this was done by means of a spindle, a thin, pointed piece of wood to which the end of the thread was fastened, and which was then made to spin round. When a convenient length had been spun, it was wound on the spindle and the operation was begun again. The thread thus spun is called yarn.

An even thickness has always been a quality aimed at in yarn, and it is evident that the finer the yarn (in thickness) the more delicate and beautiful the cloth which could be woven from it. The Hindus became wonderfully expert in producing a fine, even thread, so that in some of their finest cloths the thread could scarcely be distinguished. These were highly prized, and "woven wind" was one of the names used to describe them. Some of the muslins imported by us from India at the end of the seventeenth century fetched as much as 30*s.* a yard.

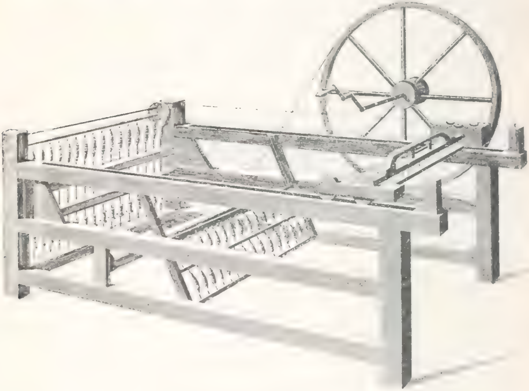
The spinning-wheel is a very old invention. The spindle was fixed on a stand, and kept in motion by a wheel, worked by hand or by a treadle, and spinning could be done much more quickly. A wooden bobbin was placed on the spindle, which was fixed horizontally, pointing towards the worker. The twisting of the thread and the winding on to the bobbin, which was done with the help of a bent arm called the *flyer*, went on together. The spinning-wheel was introduced into England in the fourteenth century.

Spinning has always been held in high esteem, and in olden days women of all classes of society, even royal ladies, practised it. English women used to pride themselves on the fineness of their yarn, and we are told that one lady gained fame by spinning a pound of wool into a thread over 95 miles long.

About the middle of the eighteenth century the method of weaving had been so improved that spinning could not keep pace with it, and weavers were often idle for lack of yarn. This set many people to work to try to find some quicker method of producing yarn, and James Hargreaves, a Blackburn weaver, invented the spinning-jenny, in which the wheel that had previously turned one spindle was made to turn sixteen or more, while one worker was able to manage it.

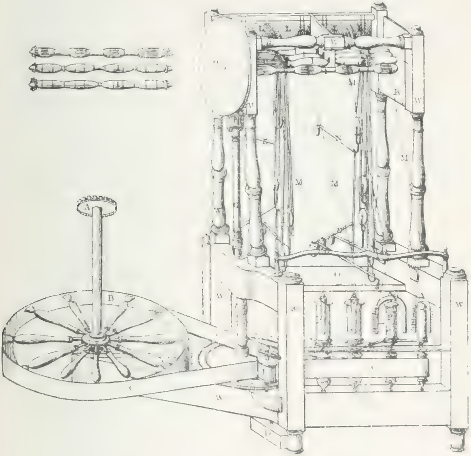
It had long been the custom to comb out the wool (or other material) with a comb or card (with steel or iron teeth) held in the hand. This straightened out the fibres so that they lay parallel, as well as removing foreign matters and short bits of fibre. The material was then formed into a loose, slightly twisted length, much thicker than yarn, but with no strength in it, called a *roving*. Ten of these rovings were then passed through a double bar which allowed a convenient length to pass and then, closing, held it while it was drawn out and spun by the rapidly revolving spindle. The yarn thus made was wound on to the bobbin, and a fresh length treated.

During the same period Richard Arkwright, a Preston barber, was puzzling over the same problem, and at last produced an improvement on Hargreaves' machine. In the spinning-jenny the spinner had to be constantly working the bar which gripped the rovings, but Arkwright's machine was automatic, and all the worker had to do was to keep it supplied with material and to "piece" the ends which broke. His first machine may still be seen in South Kensington Museum.



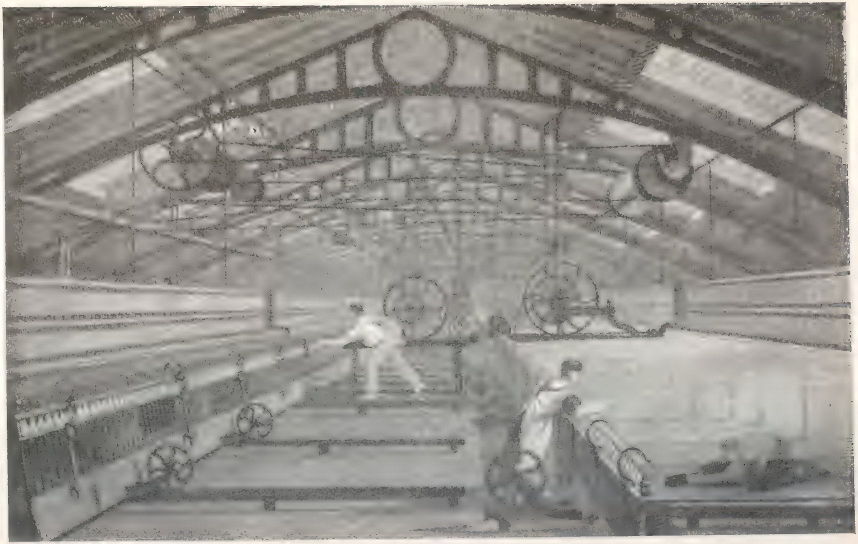
Hargreaves' Spinning Jenny

The new machine was first driven by a horse walking round in a circle driving a sort of capstan, a method still used for some purposes. A few years later Arkwright set up a small factory at Cromford, in Derbyshire, with improved machines, and as water-power was used instead of horse-power the machine got the name of the "water-frame." It was not long, however, before steam was employed, and spinning factories began to spring up rapidly. As in some cases disused corn-mills were employed at first, people got into the habit of speaking of "spinning mills," though the word *mill* comes from a root meaning *to grind*, and to this day factories, in the north of England, are nearly always called mills.



Arkwright's Spinning Machine
(*Patent* 1769)

The next great advance in spinning was made by Samuel Crompton, whose great aim was to produce better and more even yarn. He at last produced a machine which has since been modified only in details, though



Mule Spinning

these have greatly improved it. A carriage on which the spindles were fixed travelled backwards and forwards from rollers which, like the old bars, gripped the rovings after a certain length had been passed through.

As the carriage travelled away from the rollers, the roving was drawn out and twisted, the yarn being wound on to the bobbins as it returned. The carriage gave to the machine the name of the "mule"-jenny, and this name is still in use. It gave a great impetus to the cotton manufacture especially; millions of spindles were soon at work, and thanks to it and the improvements in weaving, which will next be described, production increased enormously.

4. WEAVING

The earliest form of weaving, though it was a great step in civilisation, was very simple. A number of threads were laid parallel to each other, with the ends fastened, to form what we now call the *warp*. Then a small wooden rod, or needle, was passed alternately over and under the threads from edge to edge, and returned under and over the threads. This was continually repeated until the piece of cloth was finished, each thread being pushed close up to the previous one by means of a light rod. The earliest cloth must have been a kind of fine matting. The thread passed backward and forward through the warp is now called the *weft*, though *woof* is an old term still occasionally used.

By an early improvement all the warp threads passed through loops, of which the odd ones were attached to a light rod, and the even ones to another rod. By pulling forward the rods alternately the weft thread could be passed straight through the angular space (called the *shed*) thus formed between the two sets of warp threads. As each thread was passed through it was pushed close up to the previous one by a light rod passed through the shed for that purpose. This was a great advance, for it enabled the work to be done much more quickly. A picture on an ancient Egyptian tomb shows a weaver at work with such a machine.

By another improvement, also very ancient, the warp was laid horizontally, and the rods, called *heald-shafts*, or heald-sticks (the loops being the healds), were raised by cords passing over pulleys and worked by treadles. The weft was at first passed through the open shed by means of a stick, but the old Romans invented the shuttle, which was thrown across with one hand and caught with the other. The width of the cloth was thus limited by the distance the weaver could reach. Various minor changes were gradually made, but the looms in use even in the fourteenth century were altered only in detail until the modern *power-loom* was invented.

In 1733 John Kay, of Bury in Lancashire, invented the "fly-shuttle," a light, narrow wooden box in which was placed the bobbin carrying the weft yarn. As it ran on tiny wheels it was easily sent flying through the shed by a jerk of the weaver's hand. In his hand he held a rod with a box at each end, and the shuttle ran into and was jerked out of these boxes alternately. Before long the boxes were fixed at each end of the loom, and the jerk given by pulling a cord or strap.

It was the fly-shuttle which, by its much greater speed of working, caused the difficulty of getting sufficient yarn to keep the weavers going, and so led to the improvement of spinning. Another improvement was the comb, or reed, which replaced the old hand rod for "beating up" the weft threads. This was a series of short vertical wires passing between the threads of the warp, and fixed at top and bottom into two stout rods of wood. It was slung so that it moved backwards and forwards, beating up the thread after each passage of the shuttle.

The plain cloth so far described, made by passing the weft over and under alternate threads, is easily varied by using more than two sets of healds, each set on its own rod, and by raising these in turn a twill or other pattern is produced. This was done in very early times. More elaborate patterns were produced by darning in designs with coloured threads. This was done even by the ancient Assyrians, and some of their mummy-garments, still preserved in the British Museum, must have been the work of real artists. The Hindus were also very clever at this kind of work, and some beautiful shawls, for example, took a life-time of labour to complete.

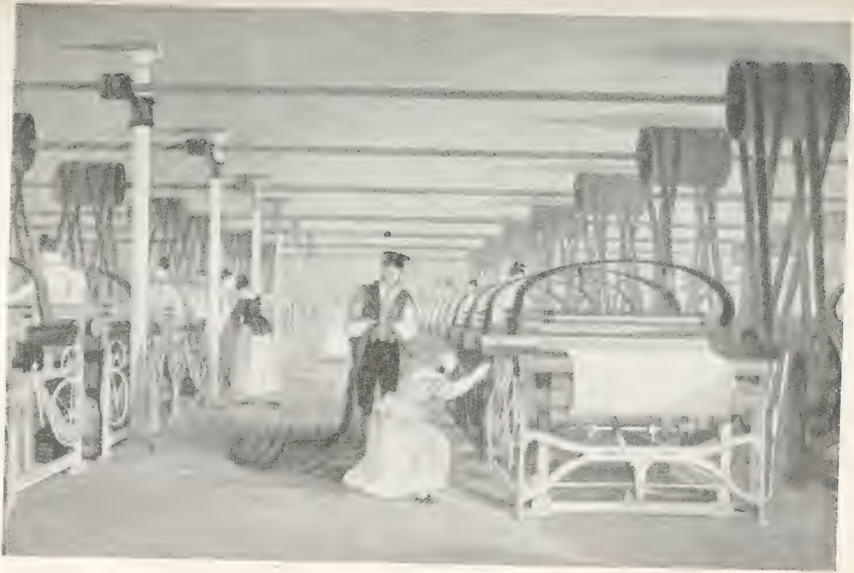
It was easy to produce a cloth of mixed colours by varying the colour of the warp threads which ran through the whole piece, but changing the colours of the weft threads was rather a tedious process until in 1760 Robert Kay, the son of John, invented the *drop-box*. He fixed a set of boxes at each end of the machine, carrying different-coloured yarns, each of which, by a simple movement, was brought into position as required, and dropped out when no longer needed.

A great advance was made when the old hand-loom, after being in use for so many centuries (though in gradually improved forms), was replaced by the power-loom. The first step was taken by a Kentish clergyman, Dr Cartwright, who, after many experiments, took out, in 1785, a patent for a loom to be worked by water or other power. The old hand-loom died hard, however, for it was over 50 years before the power-loom came into general use, and for many years after that time, even, a dwindling number of old hand-loom weavers still earned a meagre pittance in their own homes.

The new loom, whether worked by water or, as it soon was, by steam-power, required careful watching, for it went on working even if the thread broke or the shuttle stuck in the web, and, in the latter case, caused damage if not instantly stopped. But as time went on the machine was made quite automatic. The treadles by which the healds were raised were moved by cams—wheels revolving on shafts which passed, not through the centre, but near one edge; the cloth was wound on to the cloth-beam; the machine stopped if anything went wrong; and all was done without interference by the worker in charge.

We have seen that with two sets of healds a plain cloth is produced, but that by distributing the warp threads among a greater number definite patterns are woven. Sometimes as many as a dozen sets were employed, but it was still impossible to produce the elaborate figures of flowers, sprays, animals, and so on, which the ancients used to portray by the tedious process of darning. But towards the end of the eighteenth century a Frenchman named Jacquard perfected—though he did not invent—the most ingenious device which has ever been applied to weaving, a device so perfect that the Jacquard loom in use to-day differs very little from the original machine.

Each single warp thread passes through a small



An early Power-loom

metal eyelet, from which a string passes to a small hook above it. This is a small upright wire, of which the top curves over, forming another hook. The tops of these hooks are all level, and a wire passes under the whole of them, so that it is evident that if the wire be raised the whole of the hooks, and therefore of the warp-threads, will be raised too, though there would then, of course, be no shed for the shuttle to pass through.

But the upright part of each hook passes through an eye in the middle of a horizontal wire, or needle, through which it can slide easily up and down. These wires are held in position at one end by a small spring, the other ends projecting in a level line. It will be seen that if any of these projecting ends be pressed, the spring will be compressed, the double hook will no longer be upright, and will be missed when the long wire raises the rest of the row of hooks, so that the warp thread will not be raised.

Now comes the essential part of the Jacquard loom—the card. The design to be woven—in a white tablecloth for example—is drawn on squared paper. In a long strip of cardboard a tiny hole is punched for each warp thread that should be raised when a certain weft thread is shot through the loom. Each weft thread has its own card, so that there may be several thousands for a single pattern. These are laced together in order and placed in position over the loom.

The mode of working is as follows. A card falls into position, and is pressed against the ends of the wires through which the hooks pass. Some pass through the perforations in the card, others are pressed back so that the hooks are out of action. The former are immediately raised by the rising wire, and their weft threads are also raised. The shuttle passes through the shed, the weft is beaten up by the reed, the card is withdrawn, the raised hooks are dropped. The next card comes into position, and the process is repeated until the complete pattern has been produced.

5. THE GROWTH OF THE WOOLLEN INDUSTRY

With the exception of agriculture the oldest, and, for several centuries, the most important of our national industries is the production and manufacture of wool. We do not know when sheep were first introduced to Britain, but there were great flocks when Caesar invaded the island, and the wealthier inhabitants of the southern part of the country were clothed in woollen garments.

The Old English, living their simple village life, and supplying their needs almost entirely by their own labour, sheared their own sheep, and their wives and daughters washed and carded the wool ready for spinning with the spinning-wheel and distaff. This was the work which chiefly filled up the time left by the ordinary household duties of the women. Then, during winter especially, when the duties of the farm made less call on the time of the men, they worked at the rough hand-loom, weaving the yarn prepared by the women into the coarse cloth which was generally worn.

Even before the Norman Conquest a trade in wool had grown up. On the Continent, in Flanders and Saxony, and in Cologne, cloth weaving had made much more progress than in England, and much finer cloth was produced. The Flemings—the people of Flanders—obtained part of their raw wool from Spain and from England, for our wool was excellent, if our work was rough, and the Cinque ports were conveniently near. Our well-drained chalk uplands, the downs and wolds, with their fine pasturage, made splendid breeding grounds for sheep, as they do still.

All English industries suffered for a while in the gloomy years that followed the Conquest, but before long the woollen industry became far more important than before. The standard of living rose, the fine fabrics of Flanders, with other foreign commodities, became in greater demand than ever, and an ever-increasing quantity of wool was sent there in return. Foreign merchants travelled in England, buying the wool of the Downs and the Cotswolds, and sending it abroad.

English cloth even became an article of export, but, better still, skilled Flemish workmen were induced to settle in England and introduce their superior methods and machines. The wife of William the Conqueror seems to have been the first to encourage this movement, and many of these foreign workmen were to be found on the estates of the Norman barons. As time went on the industry spread in Yorkshire—where much of the land laid waste by William was turned into sheep farms—in Westmorland, in Norfolk, and in the west of England. During the thirteenth and fourteenth centuries the export of wool was the great feature of English commerce.

About the middle of the fourteenth century the terrible plague known as the Black Death swept away from a third to a half of the people of England. This dire calamity had a far-reaching effect on the condition of the country in several ways. One result was, naturally, a great dearth of labour, and serious trouble also arose in connection with the question of wages.

Hitherto the first aim of the owners of estates had been to produce all that was needed for the supply of their own needs in the way of grain, wool, and other produce, and the wool trade depended largely upon the surplus after these demands were supplied. But it soon occurred to employers of labour that both the difficulties just mentioned might be overcome by turning attention to the rearing of sheep for wool.

The number of shepherds required to look after the flocks of sheep grazing over a given area is considerably less than the number of labourers necessary to cultivate the same land as arable land, and was still more so in those days, when the spade, the plough, and the sickle had not been replaced by machinery. A large proportion of the plough-land of the country was therefore turned into pasture land, and the number of sheep, with the consequent output of wool, increased enormously. The production of wool for the market thus took first place.

For two centuries this went on, encouraged by the increasing value of wool, until it became a national grievance. To make matters worse, the landowners, whose power in parliament was almost unchecked, enclosed, for the same purpose, a large proportion of what had hitherto been *common land*, over which their poorer neighbours had rights.

Sir Thomas More, in his *Utopia*, voices the general complaint. "Your sheep," he says, "that were wont to be so meek and tame, and so small eaters, now, as I hear say, be become so great devourers, and so wild, that they eat up and swallow down the very men themselves. They consume, destroy, and devour whole fields, houses, and cities." He complains that even the Abbots, "holy men no doubt....leave no ground for tillage, they enclose all into pastures: they throw down houses, they pluck down towns, and leave nothing standing, but only the church to be made a sheep-house." By the end of the sixteenth century, however, things had, to a large extent, righted themselves.

The wool-merchants, formed, like other traders, into "gilds," became very wealthy and powerful, and it is interesting to notice that many of our fine old churches, with their beautiful architecture, especially in Norfolk, Suffolk, Gloucestershire, and Somersetshire, we owe to their wealth and public spirit.

The greatest impetus to the manufacture of woollen cloths during this period was given by Edward III, who was anxious to transfer the industry from Flanders to England, and who encouraged large numbers of Flemings to settle in England, and even in Wales. They were regarded by their English rivals, at first, with rather unfriendly feelings, but their coming was really a great benefit, the manufacture developed rapidly, and before long a large proportion of our wool was spun and woven at home instead of being exported.

The finest cloth was made in Norfolk, where the Flemings chiefly settled, but Yorkshire made great quantities of coarser qualities. It seems strange to us, now, that nearly the whole was produced in the North and East Ridings, especially at York, Ripon, and Beverley. The West Riding was then one of the poorest and most backward regions in the country.

The best English cloths were often sent to Flanders for dyeing and fulling, the Flemings being still superior in those arts. Scarlet was the favourite and most expensive colour, while the cheaper cloths were usually black. There were a good many varieties of material made—canvas and frieze, serge and buckram, tertian, tammy and kersey, bays, says, arras, and mockado.

6. THE GROWTH OF THE COTTON INDUSTRY

Cotton is the product of a plant which is found native in tropical regions all over the world, and which has been introduced into many temperate countries. From its lightness and power of absorbing moisture it forms an excellent material for clothing in hot climates, and has been in use for that purpose for ages in the lands where it is found. It may fairly be counted as one of nature's most valuable gifts to mankind.

There are several distinct varieties of the plant, and its flowers vary in colour, some being white, others yellow or purple. The seed, which ripens, as in other cases, after the fall of the flower, develops as a covering a mass of white silky fibres, in a kind of pod or boll, from which they eventually burst. These fibres, which vary in quality according to the species and variety of the plant, are the cotton of commerce.

The cultivation of cotton was introduced into the southern states of America about 1770, and for many years after that was carried on by slave labour, as readers of *Uncle Tom's Cabin* will remember. America is the chief source of our cotton supply, though the West Indies were so before the nineteenth century. The finest variety is the Sea Island cotton grown in the mild sea-air of the islands off the coast of Georgia, surpassing all others in the length, strength, and beauty of its fibre.

The value of the raw cotton imported into the United Kingdom in 1912 was over £80,000,000, of which the United States furnished about 55, and Egypt 20 millions, the cultivation of cotton having increased enormously under the fostering care of Great Britain. It will be seen that our imports from all other countries are trifling in comparison, though the cultivation is being encouraged in India, Australia, Nigeria, and other British possessions.

Cotton-picking

The manufacture of cotton cloth has probably been carried on in India longer than in any other country. Five centuries before the Christian era cotton was, as it has ever since been, the chief material of Indian clothing, yet hardly any advance was made in the primitive machinery employed until, in recent years, British spinning and weaving machinery was introduced. Many factories are now at work, and, owing to the cheapness of labour, may yet become a serious rival to Lancashire in supplying the Indian market.

The Romans imported cotton fabrics from India, and prized them highly, and the wonderful fineness of some of these has been already mentioned. The first attempt to imitate them seems to have been made in Italy, and from there the new manufacture was carried to the Low Countries, whence it was brought by Protestant refugees to England about the beginning of the seventeenth century.

An interesting record, published in 1641, tells us: "The town of Manchester buys linen yarn from the Irish in great quantity, and weaving it, returns the same again in linen into Ireland to sell. Neither does her industry rest here; for they buy cotton wool in London that comes from Cyprus and Smyrna, and work the same into fustians, vermilions, and dimities, which they return to London, where they are sold, and from thence not seldom are sent into such foreign parts, where the first material may be more easily had for that manufacture."

We learn that at that time the weaving was chiefly done in the Bolton district, where at the weekly market Manchester dealers bought the pieces, afterwards finishing them and either selling them to customers in the country or sending them to London for export. Then, and long afterwards, the warp was of linen yarn, for spinners were as yet unable to produce a cotton thread strong enough for warp, the weft only being of cotton. The weaver bought the linen yarn, the "cotton wool" for weft was carded and spun by the female part of his family, and he and his sons wove the cloth, so that each weaver's cottage formed a separate little factory.

Even before the eighteenth century the number of patterns and qualities produced was surprising—fustians, diapers, dimities, jeans, and other varieties figure in the list. At a later time figured goods, cotton velvets, velveteens, and strong and fancy cords were added. Many improvements in finishing, dressing, and dyeing were due to a Manchester manufacturer named John Wilson, and helped largely in the rapid increase of the home and foreign trade.

Still more was this due to the outburst of inventive genius which has been already traced. It was Arkwright's invention which made it possible not only to produce cotton yarn strong enough for warp, but to keep pace with the increasing demands of the weavers. Early in the eighteenth century the mule-jenny invented by Crompton had been so improved that a spinner could manage two mules at once, each with as many as 400 spindles, one mule moving out while the other was returning. The fineness and evenness of the yarns produced by the mule were so great an advance that it introduced the manufacture of the finest fabrics, such as muslin and lawn, which had previously been impossible in England.

The industry soon spread throughout the Lancashire towns; Blackburn and Preston became the great seats of calico weaving, and from thence it spread into Yorkshire, first to the Colne district and then as far as Bradford.

New varieties of fabrics were constantly introduced, and the rapid increase of trade stimulated other industries concerned. Great strides were made in the methods of bleaching, dyeing, calico-printing, and other allied processes.

It should be noted that, on account of its cheapness, cotton is often worked up with other fibres. Thus "union" fabrics of cotton and linen are largely made, which, while cheaper, are less durable than pure linen. Woollens and worsteds often contain a considerable percentage of cotton, which reduces both the cost and the wearing qualities of the fabric, though the buyer of the cheap suit, or other article, is usually ignorant of its presence. It can be detected, however, by pulling a thread apart, and noticing the contrast between the crinkly woollen fibres and the straighter cotton fibres of which it is made.

It is even mixed with silk, which is much more expensive. Such, too, is the ingenuity of modern methods that cotton alone can be so treated that fabrics are made which, on a casual inspection, may be easily mistaken for silk.

Nothing in our industrial history is more astonishing than the growth of the cotton industry. Before the invention of the improved machinery already described, the whole amount of yarn produced in Britain was less than that now turned out by many single factories. Cotton goods—yarns and fabrics—are now by far the most important of our productions, the value of our annual exports, apart from the vast quantities used at home, being over £120,000,000. A century ago the value of the total produce was about £1,000,000. About 50 million spindles are to be found in the cotton-spinning factories of Great Britain—over one-third of the total number in the world.

7. THE WOOL INDUSTRY OF TO-DAY

At the present time nearly 900 million pounds of wool is manufactured in Britain each year, of which not much more than one-seventh is grown at home, the rest being imported chiefly from the great wool-growing countries, Australia, New Zealand, and Argentina. Many other lands, however, from Iceland to Persia, from Peru to China, contribute to our supply. The great bulk of the imported colonial wool is sold by auction at the Wool Exchange in London, the periodical sales being attended by brokers, and buyers from all the wool-manufacturing centres in the kingdom.

Two-thirds of the imported wool comes over "in the grease," as it is taken from the sheep's back, and usually loses quite half its weight in the cleansing and scouring through which it has to pass. The rest is scoured before being shipped, or comes as "skin wool," on the skins of slaughtered sheep. Wool varies greatly in value, according to the breed of the sheep and the part of the fleece from which it is taken. The fine wool from the shoulders, for example, is much more valuable than that from the legs, which is longer and coarser. "Wool-sorting," which is performed with great skill and quickness by expert workers, is quite an important process.

The length of the fibres may vary from an inch to over a foot, but the value depends chiefly on the fineness, the curl, and the abundance of the overlapping scales. A considerable quantity of old wool is used, made from woollen rags, which are torn into a fluffy mass of short fibres. This is used in cheap materials, for it has lost much of its curl and spring, and the edges of the microscopic scales, on which the strength of the yarn so largely depends, have been partly worn away. This explains why cheap fabrics so soon lose their shape—why cheap trousers, for instance, so soon become baggy at the knees.

There are two great divisions of the trade, the woollen and the worsted industries. Both classes of goods are, of course, made from wool, but the treatment of the material is quite different almost from the first, and the distinction is a very important one. Speaking generally, old wool, and various substitutes, such as cotton and other fibres, are used, mixed with varying proportions of new wool, according to the quality desired, in *woollen*

Wool Store, Adelaide

goods, in which *felting*, that is, the interlocking of fibres lying in all directions, is the prominent feature.

In worsted goods, on the other hand, the carding and other treatment of the wool before spinning is designed to bring the fibres parallel to each other, and the spinning is carried out much more thoroughly. In this way finer, as well as stronger and more wiry threads, are produced, the threads are distinctly seen in the finished cloth, and the patterns produced by the use of yarns of different colours are often extremely minute.

The classes of goods produced from wool—cloth for men's clothing, dress goods for that of women, blankets, carpets, under-clothing, and many others—are so numerous and widely different, the variety in these classes is so great, the processes and the machinery employed are so complicated, that only a few of the most important points can be considered in this book.

The processes in manufacturing woollen yarn are far shorter and simpler than those for worsted. The wool, after being cleansed, cleared of burrs, foreign fibres, and other impurities, and then oiled, is carded, passing through huge carding machines, composed of many horizontal rollers and much larger cylinders, covered with "card clothing" of bent wire teeth set in leather, so that they may give fairly readily. These revolve at varying speeds and in different directions, the teeth of one approaching, or even passing between, those of another. The speed, the size, closeness, and angle of the teeth, as the outcome of long and careful experiment, vary according to the part of the work that has to be done.

As a result, the wool reaches the last roller as a gauzy film of fibres, intermingled in all directions, yet with a

Worsted Mills, Greenock

surprising amount of cohesion. From this it is removed by two "doffing" rollers with alternate rings of card clothing and smooth leather. The narrow bands of wool thus stripped off are passed between two broad leather belts, which rub together like a pair of hands, turning them into round, loose ropes of untwisted fibre, which are wound on bobbins ready for the spinning mules. These ropes are *slivers*, or *rovings*.

For worsted yarns the wool has to go through quite a number of processes. Short wools are first carded, though much more gently than for woollen yarn, for fear of breaking the fibres, and leave the carding machine in the form of sliver. Long wools, which would have their fibres broken by carding, are passed through a series of *gill boxes*, which comb and straighten out the wool, the slivers being repeatedly put together and drawn out again finer than before. The carded wool is also passed through a couple of gill boxes before being combed.

The chief object of the next process, combing, is to separate the longer wool, or *top*, from the short, or *noil*, the latter being usually disposed of to make woollen yarn, in which length of fibre is not so important. There are several types of comb, but in all the top is finally delivered, thoroughly combed, into a can as a continuous band. In the next set of processes the sliver is drawn through machines of which the chief feature is two pairs of rollers, between which it passes. As the second pair revolves faster than the first, the sliver is drawn out thinner, and is then wound on to bobbins. The bobbins get smaller, and the thread thinner and slightly more twisted, in each machine. At each step, moreover, two or more slivers are combined into one.

The rovings, as they are now called, are ready for spinning. There are several types of spinning frame, all developed from Arkwright's water-frame, but the mule, with its moving carriage, is sometimes used for worsted and always for woollen yarn. In either case the condensed sliver is paid out from the bobbins by fixed rollers, the revolving spindles of the moving carriage complete the drawing and impart the necessary twist as the carriage moves outwards, the twisting is continued for a few seconds, and the finished yarn is wound up as the carriage returns.

The principles of weaving have already been described, but many ingenious improvements have been made, and the modern power-loom is a wonderful piece of mechanism. Once the weaving is started, supervision alone is required, but the mounting of the loom needs considerable care and hand labour. All warp must be carefully handled, and in fancy weaving each one of hundreds of threads must be in its place, when the warp is wound on the warp beam, or the pattern will be spoiled. Hence a long piece of material is woven each time the loom is mounted.

Very rarely are all the processes we have described carried on by a single firm. Weavers usually buy the yarn ready for weaving, and indeed spinners frequently buy their wool already prepared as tops. Some towns, even, are almost entirely engaged in spinning, others in weaving. Much might be said, too, of dyeing, which is a distinct trade, and the dyeing may be done in the wool, in the yarn, or in the piece.

8. LINEN AND SILK

Linen is probably the oldest known textile. It is often mentioned in the oldest books of the world, and some specimens to be seen in our museums, from Egyptian and other ancient tombs, are perhaps 4000 years old. In Britain "much fine linen" formed part of the spoils of the old Danish plunderers. But the great Ulster industry arose less than a century ago, replacing cotton-spinning, which was then rapidly dying out there.

Flax, which when spun and woven becomes linen, is the fibre of a small-leaved plant, growing from 20 to 40 inches high, and bearing bright blue flowers, the seeds of which we know as linseed. After being pulled up by the roots, the seeds are removed by "rippling" with a kind of comb, and the plant goes through the process of *retting*, or rotting, in ponds supplied with pure, soft water. After soaking in these for about a fortnight the fibres readily separate from the woody core, and the flax straw is spread out for about an equal time, on the grass, for this to take place. The treatment, however, varies to some extent.

By *breaking* between grooved rollers, and then *scutching* in a machine with revolving blades, which beat out the broken woody part, the flax fibres are obtained, ready for spinning. The operations which follow differ only in detail from those described in connection with cotton and woollen fabrics, but by the modern method of *wet-spinning* the partly-spun fibre is passed through warm water before being finished.

For ages this was a purely domestic industry; the small farmer, or even cottager, in many countries, grew his own patch of flax, and it was retted, scutched, cleaned, spun, woven, bleached, and finished on his own premises and by his own family or servants. It was not until machinery and the factory system had so increased the output of cotton and woollen cloth as to threaten to kill the linen industry, that the same methods were adopted, and a new chapter of the history of linen commenced.

Spreading Flax

It is only in Ulster that flax is now grown to any extent in the United Kingdom, and even there only a fraction of the amount used. Of recent years all the coarsest flax has been imported from Russia, all the finest from Belgium. Even large quantities of yarns are imported, especially from Russia, though we also export yarns to other countries. Our exports of linen cloth and yarn for 1913 were valued at £9,500,000. (Compare this with the £127,000,000 of cotton.)

The many varieties of linen vary from heavy goods such as sail-cloth, canvas, and sacking to the finest cambrics and lawns, Dundee being chiefly engaged in making the former, while the latter are mostly Irish. Between these come linens for tent-making, towelling, "duck" suits for men, coverings, linings, and for many other purposes, including plain bleached linens for shirts, collars, bed sheets, and so forth. Twilled linens comprise drills, diapers, and damask, the last including the beautiful figured materials used for table-cloths and similar purposes. The various towns and districts engaged usually make a speciality of one or more classes of goods. Sewing thread, lace thread, and twine for various purposes are other special branches.

Linen excels cotton in strength, and in its smoothness and lustre. Having a less "woolly" surface than cotton it does not soil so readily, nor does it absorb and retain moisture so freely. These qualities make it a cool, clean, and healthful material for bed-sheeting and clothing.

Silk was manufactured in China, according to their records, over 4500 years ago, but the secret was so jealously guarded that it did not pass even to Japan until the third century of the Christian era. The beautiful material found its way to Europe, and among the ancient Romans was literally worth its weight in gold. The manufacture was firmly established in England by Flemish refugees in the sixteenth and French refugees in the seventeenth centuries.

The head-quarters of the industry were in Spitalfields, but after the steam-engine and the power-loom came into general use it began to dwindle, until now it has almost died out there. The first silk-throwing mill in England was built by John Lombe, at Cromford in Derbyshire. Lombe went to Italy about the year 1700, worked for some years in a silk factory, brought away, at the risk of his life, particulars of the machinery and processes in use, and put them in practice on his return. He is said to have been eventually poisoned, in revenge, by Italians who came over for the purpose.

As a continuous thread can be obtained from the cocoon of the silkworm, there is no carding or combing to be done, but in the operation of *throwing* a number of these gossamer-like threads are twisted together. The thread thus obtained is stronger than an equally thick one of either cotton or linen. It goes through a variety of processes, including the removal of the gummy matter natural to it, according to the purpose for which it is to be employed, whether as a thread for sewing, embroidery, and so on, or as yarn for weaving.

Silk is the most beautiful of fabrics, from its softness, smoothness, and splendid lustre, also from the beautiful effects which can be produced by dyeing, which is done in the yarn. The beauty and lustre are not apparent until after the operation of *scouring* has removed the gummy matter referred to above.

A good deal of the silk is not obtained in a continuous thread for throwing, but as *floss* silk. This, including the silk from damaged cocoons, and all other *waste*, is carded and spun on the same principle as that applied to cotton, but it loses much of the beauty which distinguishes the thrown silk. Pure silk is very expensive, so that it is very liable to adulteration with other fibres, such as linen or cotton.

A great deal of weight is often added in dyeing.

Many fabrics are also woven with mixed yarns in such a way that the silk appears on the surface, while the base of the fabric is of linen or cotton. In fact, pure silks, satins, and velvets are much less common than spun silk, or materials of which silk forms only a part.

9. LEATHER. BOOTS AND SHOES. STRAW PLAIT

The striking contrast between the skin of an animal and the leather which is made from it is brought about by the process of tanning. The importance of this industry is evident when we think of the many articles—boots and shoes, bags, harness, gloves, and so forth—made from leather, and its use in upholstering, book-binding, and in many other directions. In addition to home supplies we imported hides and skins to the value of over £15,000,000 in 1913.

All skins are capable of being made into leather, but the ones chiefly used are those of oxen and horses, known as hides, and those of smaller animals—calves, sheep, pigs, goats, and a few others—known as skins. The hides and skins are either *tanned*, by combining them with tannin, *tawed*, by preparing with alum or other salts, or *shamoyed*, with oils and fatty matters. The first and most important method produces the harder and tougher leather used for boots, bags, harness, and so on; the second the softer leathers used for gloves, "calf kid" shoes, linings, and other light work; a piece of "chamois" or "shammy" leather is a good example of the third.

Tannin is a substance contained in bark (oak bark producing the best leather), and other vegetable matters, which combines with the substance of the skin, making it thick, hard, tough, and durable, and almost incapable of decay. Tanning is a long process, and involves many operations, of which the essential one is the steeping of the skins, after the hair has been removed, for several weeks in the tan-pit, with the ground-up bark, or other tanning material, and water.

In the manufacture of leather goods, as in so many other industries, machinery has taken the place of handwork to a marvellous extent. In the most important branch, for example, the making of boots and shoes, the old bootmaker, who made perhaps a couple of pairs in a week, has almost entirely disappeared. His place has been taken by huge manufactories, some of which, at Northampton, turn out over half a million pairs each year.

Here, instead of the grimy six-storey buildings familiar in the cotton and wool working towns, we find buildings often with a ground floor only, and the grounds even adorned with lawns and shrubs. Entering one building we find thousands of pounds' worth of leather stored—hard sole leather, stout serviceable leather for "uppers," patent leather, suède—leather for all kinds of purposes from a navvy's boot to a dainty slipper for a lady.

In the *clicking-room* scores of men are busy cutting out uppers, in some cases as a cook cuts out tarts with a sharp-edged shape, except that they have a machine to do the pressing. In another department hundreds of power-driven sewing machines are at work, tended by girls, sewing the pieces together. Everywhere ingenious machines, many of American invention, are seen. One is sewing on buttons; a girl keeps it supplied with buttons, the machine arranges them with the shanks all one way, carries them along a groove to the boots, holds them in position while the needle darts through the shank and the leather, and in a minute or so the whole row of buttons is finished.

Here a group of machines are at work on what are to be lace-up boots. Each machine arranges the eyelets, or hooks, as the case may be, carries them to the upper, punches the holes, places the hooks in exactly the right position, and clinches them behind. A solid boot flap enters another machine, a tiny knife and a needle are seen darting to and fro, and out it comes with a row of button-holes, neatly sewed and finished.

"Pressing the heel" in a Northampton boot factory

In another department soles and heels of all sizes and various thicknesses are cut out by a heavier machine than that used for the uppers. Let us follow the course of a heavy or *welted* boot, to see the upper and sole put together. The *insole*, or inner layer of the sole is fastened to the last, or shape, by a couple of tacks. The upper is placed over the last, and its edges seized by three pairs of pinchers of the pulling-over machine. These pull the edges over the insole and the machine drives in a few tacks to keep them in position, the heel part being fastened by hand.

After further tightening the welt, a narrow strip of leather is placed round the sole, and stitched by a machine with a curved needle with the upper to the insole. This machine does in one minute as much work as a cobbler could do in an hour. Then the shaped sole is fixed with rubber solution to the insole, and stitched on by a heavy machine. The heels are shaped in a mould under a pressure of several tons, and the machine which nails them on drives fourteen nails through heel and sole at one stroke. Even the attractive finish is given by machinery, and when the boots, shoes, and slippers reach the stock-room, ready to be sent to all parts of the world, they certainly represent a wonderful achievement of mechanical skill.

As a contrast to the manufactures we have been considering, in which machinery has played such a revolutionary part, we may take one which has remained to an exceptional extent a "domestic industry," the making of straw-plait for women's and men's hats. In many lands grasses of various kinds are used for this purpose, and some of these hats, as the best varieties of those which take their name from Leghorn in Italy, and Panama in Central America, are very expensive, on account of their excellence and the time they take to make.

In England the straw-plait industry has been carried on in Luton, Bedford, Dunstable, and the surrounding villages, for over three hundred years. Forty years ago about 50,000 people were thus employed, but the number is much less now. For one thing, vast quantities of straw-plait are imported, chiefly from Canton, for in China labour is very cheap, and our home product cannot compete in price, in the lower grades especially, with the foreign article. But in many a home still in these towns and villages the women and children produce straw-plait with the skill and quickness born of long practice.

The straw of certain kinds of wheat grown in that area is specially suitable for the purpose, from its length, its fine bright colour, and its strength, though these qualities vary with the season. The corn is cut in the usual way, but the straw is dried in the sun before binding into sheaves. From selected straws the two upper joints are cut. These *pipes* are sorted into sizes, those of good colour are bleached by fumes of sulphur, and the rest are dyed, either "in pipe" or "in plait."

The straw is worked in a damp state, to soften it and make it easy to manipulate, either as whole or split straw. In the latter case the straw is split with a small instrument with a projecting point from which radiate as many tiny knife-edged cutters as the number of strips desired. This is inserted in the pipe and run from end to end. There are workshops in which women and girls are employed regularly; apart from these the plait made at home, as a means of adding to the family income, is taken to the warehouses or called for by agents.

The plaits are sewed partly by hand and partly by machine, the hats or bonnets are finished by stiffening with size and blocking, by heat and powerful pressure, into the many shapes which, in the case of women's hats especially, fashion from time to time demands.

10. PAPER MAKING

Paper is used so universally and for so many purposes that it is difficult to imagine what we should do without it, especially for written and printed matter, and indeed nothing could take its place in modern life. But ages ago it was unknown even among highly civilised nations, and such records as were made were necessarily inscribed on other substances.

The earliest writings were recorded on stone, afterwards on bricks or clay tablets, and such records, thousands of years old, may be seen in our museums. Another primitive method was the use of slabs of wood or the bark of trees. Our word book, indeed, is supposed to be derived from the name of the beech, from the fact that our northern ancestors in early times used to write on the bark, or perhaps thin boards, of this tree. Suitable leaves of trees and other plants were also used for this purpose, and the use of the word leaf in connection with books may be derived from this fact.

Tablets of ivory or metal were used by the Greeks and Romans, who also employed thin sheets of wood—beech, fir, or citron—coated with wax, on which the words were inscribed with a sharp-pointed stylus. These tablets were in use in Europe until the middle ages, though the Greeks had learnt from the Egyptians the use of papyrus, from which we get the word paper.

The papyrus was an Egyptian reed which grew to a height of about six feet. The stem was cut into strips which were laid side by side, other strips being laid across them, probably with some kind of paste, the whole being pressed together into sheets. The papyrus thus produced was dried in the sun, and rubbed smooth with ivory, ready for being written upon, sometimes with a stylus, sometimes with a reed pen and ink of various kinds. A papyrus taken from an Egyptian tomb, and now preserved in Paris, is probably 4000 years old.

Prepared skins—sheepskin, known as parchment, and calf-skin, known as vellum—were also used in ancient times, and, on account of their durable nature, remain still in use for important documents, though they are naturally rather expensive.

Paper, as we understand it, is composed of vegetable fibres reduced with water to a fine pulp, which is then spread on wire-cloth so that the water can pass away, leaving a thin layer which, on drying, becomes paper. Many fibres are suitable for the purpose, and those chiefly used are the fibres of flax (the best paper being made from linen rags), wood, cotton, esparto grass, straw, jute, hemp, and manilla; wool being rarely used. The material used varies with the purpose for which the paper is to be employed, the chief varieties being writing, printing, and wrapping paper.

A document still exists, written in 1102 A.D. on paper made of cotton, a writing material that had long been used in the East. Paper was first made from rags, probably woollen, in the twelfth century, while linen seems to have been first used in the fourteenth century. We owe the introduction of the industry into England to Flemish or Huguenot refugees, by whom also the earthenware and cutlery manufactures were greatly benefited.

In the manufacture of paper from rags, the rags are first cut into pieces about the size of the hand, and the different qualities cotton, linen, etc. sorted out. They are then passed through machinery which thoroughly removes the dust, and boiled for ten or twelve hours in water with caustic soda. After being washed to remove the latter, they are passed through a "breaking-engine," a large iron trough in which they are converted, by knives attached to an iron roller, into a coarse pulp. Chloride of lime is added, and the mass is run into stone chests in which it remains for 24 hours to bleach.

At this stage begins the paper-making proper. The pulp, whether from rags, wood, esparto, or other material, is "beaten" in a beating-engine, the object of which is to reduce the fibres to a length suitable for the class of paper to be made, and to beat them to a stiff pulp to which water is to be added. It is an operation requiring great skill and experience, for each kind of fibre has to be differently treated, and the class of paper required has also to be taken into account.

During the beating, any colouring matter is added, and also, for writing and printing papers, some form of size, such as powdered resin, to fill up the spaces between the fibres, so that the paper will not absorb the ink to be used later. Without this, the paper would be of the nature of blotting-paper, which is, of course, unsized. It is also usual to add, except for the very best qualities of paper, some 10 or 15 per cent. of "loading," such as china clay.

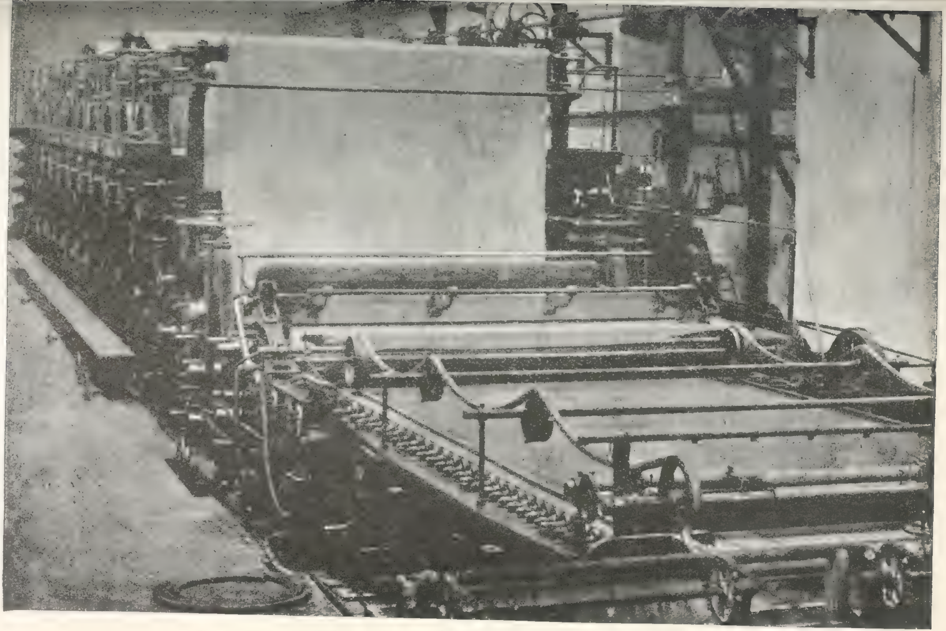
This lowers the cost of the paper, and also helps to fill up the pores, and to render the surface capable of being more readily and evenly glazed. When, for the sake of cheapness, an excessive amount is added, the paper suffers in strength and quality. Most materials, however well bleached, have a yellowish tinge, and this is corrected by adding a small amount of blue and red colouring matter to produce whiteness.

A certain amount of expensive "hand-made" paper is produced from pulp, but by far the larger proportion is machine-made. The paper-making machine is rather complicated, but the general principles are easily understood. The pulp is run into large chests, from which it is delivered, after being thinned down with water to a very liquid pulp, to the wire. On the way it passes through a strainer, which retains any portions which have not been properly reduced.

The wire is an endless sheet of fine brass wire-cloth, kept perfectly level by a series of brass rollers, over the upper surface of which it slowly passes, to return underneath. On the upper surface of the wire the pulp, coming from the strainer, spreads in a thin film, and is kept from flowing over the edges by endless rubber straps, while the "shake" keeps the wire moving from side to side so that the pulp may spread quite evenly. The "watermark" is produced by a revolving wire-cloth roller, carrying the design in raised wires, which presses the top of the pulp as it passes.

The water is drawn through the wire-cloth by suction, and at the end of the upper surface the partly dried pulp, or paper, is received between a pair of rollers. After this it passes between various rollers, and round steam-heated, polished iron cylinders, which dry the paper and give a glossy surface. Finally, it is wound on reels, which are removed as they are filled. Many writing papers are then sized and passed over a drying machine with drums, sometimes as many as 200 to a machine, on which they are gradually dried. The sizes of paper required are then cut by suitable machines.

The width of paper produced varies from about 60 to as much as 150 inches, and for newspapers and



Paper-making machine

similar work the web is made and delivered to the reel at the rate of as much as 530 feet per minute.

The enormous demand for cheap literature has led to many experiments to find suitable vegetable fibres to replace linen rags, and the use of wood pulp, especially, has grown tremendously. It forms probably four-fifths of the material used in the book trade. The drawbacks of wood pulp are weakness of fibre, and the tendency of the paper to discolour and become brittle with time and exposure to air and light. For newspapers this does not seem to be a very serious matter. Esparto grass makes a better, but more expensive paper, while that made from linen rags, costing five or six times as much as wood-paper, is, naturally, only used for the most expensive books. Various materials, however, are usually mixed in different proportions.

The wood pulp is imported chiefly from Norway and Canada, and of this and other paper-making materials we import more than £5,000,000 worth each year, together with paper to an even larger amount. The varieties of paper and the uses to which they are put are very numerous, and the industry is carried on over a large part of England and Scotland. Writing and printing papers are made in Kent, at Maidstone, Sittingbourne, and other towns, in Hertfordshire, Lancashire, Derbyshire, the neighbourhood of Glasgow and Aberdeen, and in many other parts of the country.

11. PRINTING. NEWSPAPERS AND BOOKS

For the origin of printing we must go back thousands of years to the bricks and clay tablets of the ancients, upon which, while yet soft, characters were imprinted by pressure with instruments cut at the end to the required shape. But in Europe, until the thirteenth century, all documents and books were written by hand, and books continued to be produced by the same method for years afterwards.

Large numbers of men, especially in the monasteries, spent much of their lives in this work, and many of their books, especially copies of the scriptures and other religious works, are still treasured. Very beautiful many of them are, too, with their wonderful penmanship, their illuminated capitals, and often cleverly executed pictures, the gold and colours of which are as bright now as when the long-dead artist laid down the brush.

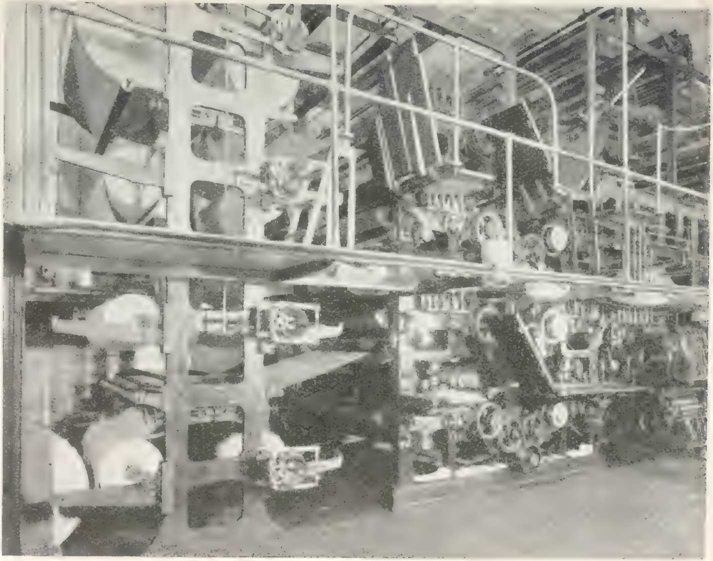
But books of this kind were naturally costly, and the invention of printing enabled copies to be produced far more rapidly and cheaply. The first method used was to carve a smooth wooden block so that a whole page of letterpress, or the lines of a drawing, stood out in relief, and this page-block, inked by hand, was pressed on sheets of paper. Thus all the pages of a book had first to be carved out, when as many copies were made as might be desired.

A great step was made when John Gutenberg cut out individual letters on slips of wood and strung these together on pieces of wire to form words and sentences, the advantage being that the letters could be used again and again in different combinations. Gutenberg and his partner, Fust, made another advance by inventing metal type, the separate letters being cast in prepared matrices, or moulds. The type was arranged, or "set up," page by page in the case of a book, tightly enclosed in a suitable frame, and when a sufficient number of copies had been printed was re-distributed in the cases ready for further use. This method is still in constant use.

It was about 1476 that William Caxton set up, in the precincts of Westminster Abbey, the first English printing press, his earliest dated book being *Dictes and Sayings of the Philosophers*. By this time a printing machine had been invented by which the type, still inked by hand, was pressed down on the sheets by a lever. From such humble beginnings were developed the mighty energies of the modern press of the world.

Mechanical invention has since made enormous progress in the direction of the saving of labour and time, and the multiplying of production. Especially have these ends been sought in connection with newspaper printing, in which time is indeed precious, and a visit to a newspaper printing office, with its beautiful and complicated machinery working at the highest speed, is quite a thrilling adventure, though it would be impossible here to describe all the wonders to be seen.

Type is still set by hand, but type-setting machines are also used, and an even more wonderful invention, the linotype machine, which, as its name implies, produces a line of type. The operator sits at a keyboard, something like that of a type-writer, but more complicated, and, as he touches the keys, tiny brass matrices, or moulds letters, figures, stops, spaces, and so on—are brought



A newspaper printing machine

together and arranged in a line of properly spaced words.

At a touch this is conveyed to another part of the machine where molten metal is poured into the mould, and lines are cast at the rate of six per minute, all trimmed and finished to the exact height, length, and breadth, the operator, meanwhile, going on with the setting of the next line. The lines thus cast are set up by other workmen into columns and pages. A thin papier maché mould is next taken of the complete page of linotype. This is then placed in a cylindrical casting box, and molten metal poured in.

The result is a solid curved plate, ready, after being planed to the exact thickness (about half an inch), and cooled, to be fixed to the cylinder of the printing machine, and as many of the plates are cast as are required for the machines. Each of the machines used in printing one of our best-known papers prints sixteen—of as many as 32 pages each—at once, and is thus equal to sixteen machines combined.

The huge rolls of paper supplied to the machine are from 4 to 4½ miles, and may be 6 miles, in length. Half a ton of ink is placed in the reservoir of the machine, and this is conveyed mechanically to the rollers which distribute it evenly over the surface of the plates on the cylinders. When the machines are started the noise is deafening, yet one feels as though one could stand watching a machine for hours, as it draws in the eight rolls of paper, prints both sides, cuts the sheets, folds them, counts them, and delivers the papers, in quires of 26 copies, ready for sending off, without a hand touching them.

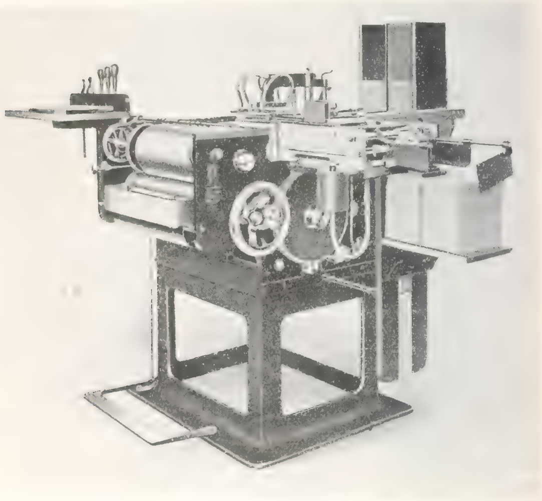
The speed at which all this is done is amazing, the paper travelling at a rate of over 800 feet per minute, while one machine can turn out 55,000 copies of a 32-page paper in an hour. Yet the machine can be set in motion or stopped with a touch of the finger. Steam-engines or electric motors are employed as the driving power. One marvellous invention should be mentioned by which a large newspaper office in the city can set up the type in a country town, miles away, without any mistake. This is done by means of a special telegraph instrument, which controls a mechanical compositor in the distant office.

In the printing of books, sheets of paper are used, each of which generally has sixteen pages, eight on each side, so arranged that when the sheet is folded the pages come in proper order, the folding being done by a machine. In some cases the sheets are left in this condition, so that the pages have to be cut by the reader of the book. Usually, however, the folded pages are piled up and placed in a machine which cuts three edges, leaving uncut that which is to form the back of the book.

The sections, each of sixteen pages, are then placed together to make the whole book. A special sewing-machine then stitches a string through the pages of each section, and binds the sections together in book form. Another machine compresses and rounds the back of the book ready for receiving the cover. Meanwhile another ingenious machine has been making the covers, or cases.

At one end the cloth covering is fed into the machine, cut to the proper size, and covered with glue. Pneumatic fingers have picked up two straw-boards which are to form the bulk of the cover, and now lay them down on the glued surface. The machine then folds the edges of the cloth over those of the boards, cuts off a strip of paper and pastes it into the back between the boards, and hands out the case complete.

By still another machine the books are pasted into the covers, and the pressure of a hydraulic press finishes them off neatly and compactly in the form in which they reach the public. The number of books published, and the number of copies of popular books issued, has increased enormously in recent years. There are single factories which can turn out 2000 or more copies every working hour of the day, so great is the demand for books. London is the great centre of the British book trade.



Case-making machine

though many of the firms have works in the neighbouring counties. This also applies to the newspaper business, many of the provincial papers even being printed in London. A great many books and papers are, of course, printed in other large towns throughout the country, and for smaller work hardly a village of any size is without its printer.

12. GREAT MANUFACTURING TOWNS. I

Manchester is one of our very old towns, dating at least from Roman days, when it was called Mancunium, and it became a chartered borough in 1301. Like several other Lancashire towns it was early connected with the woollen industry; indeed it was the chief centre of that trade in the north of England in the time of Henry VIII. The Irwell, Irk, and Medlock, now of little importance, were then valuable sources of water-power.

Its connection with the cotton trade dates back to the early part of the seventeenth century, the material being brought from Cyprus and Smyrna. It is now the centre of the cotton industry of the world, not so much from its actual manufactures, as from its position as the great market from which the raw cotton, brought by the Manchester Ship Canal or by rail from Liverpool, is distributed to the surrounding towns, and the yarn and cloth are sent from its many huge warehouses all over the earth.

Manchester and the borough of Salford, only divided from it by the Irwell, contain over 945,000 people, and a circle of ten miles radius round Manchester, which

Manchester Ship Canal

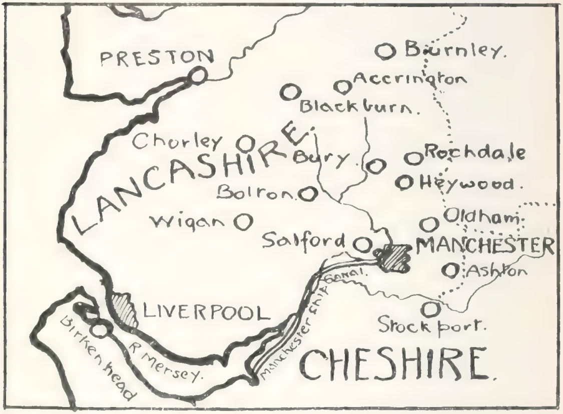
would include also Oldham, Bury, Stockport, Ashton-under-Lyne, and smaller towns, would contain a larger population than any equal area in the United Kingdom except a similar circle round London. The Royal Exchange, with its crowds of members representing cotton broking, spinning, weaving, bleaching, dyeing, and so on, is the very heart of the world's cotton trade.

The public spirit of the citizens is shown in the splendid buildings, such as the Town Hall, the Art Gallery, the University buildings, and many others. The Victoria University, which includes colleges in other towns, was founded in 1880. The splendid water supply of the city is brought from Thirlmere, a lake in Cumberland. Railways intersect not only Manchester itself, but the whole of the surrounding districts, in which the amount of goods and passenger traffic is enormous, while there are also over 50 miles of electric tramways. The Ship Canal, over 35 miles long, enters the Mersey at Eastham, near Birkenhead, and enables ocean-going vessels to be berthed in the very heart of the city.

Oldham, six miles from Manchester, is mentioned in Domesday Book, but its growth into a large town of nearly 150,000 inhabitants is due to cotton. Spinning is the one great industry, for something like a tenth part of the world's cotton yarn is produced here, the finest and most up-to-date machinery being installed in its great factories. A large quantity of coal is raised in the neighbourhood.

Like most of these Lancashire cotton towns, it cannot boast of much in the way of beautiful scenery. The absence of trees and grass gives a dreary appearance to the large working-class quarters. Busy industry is the feature which most strikes a visitor. Thousands of workpeople stream into and out of the factories, or mills, when work starts or stops, most of the women in shawls, and nearly all in clogs, with wooden soles protected by iron rims, the clatter of which at these times seems tremendous to one not accustomed to it.

Yet good wages are earned in these towns, the people are for the most part comfortably off, and in the summer holidays called "the Wakes" at Oldham, the mills are closed and the towns seem almost empty, so many of the people being away at Blackpool and other seaside towns for a week or more.



The Cotton District

Bolton (180,000) is another ancient town, once famous for its woollen cloth, Flemish weavers having settled here in the fourteenth century. It was also formerly noted for its fustians and muslins, but is now engaged chiefly in spinning very fine "counts" in cotton yarns. Its bleaching, dyeing, and calico-printing are also important. Its history has not always been peaceful, for it endured three sieges in the Civil War.

Rochdale deserves mention as the cradle of the co-operative movement which is now so wide-spread. In 1844 the "Rochdale Pioneers," a small band of workmen, opened a small store with money saved from their wages, little thinking what a large and wealthy body their society was destined to become, and how widely it was to be copied. It was not many years before they started a co-operative spinning-mill.

Besides cotton spinning and weaving, flannel, baize, and fustians are important branches of its industry. The woollen manufacture, which thus survives, owes its development to the Flemish weavers who set up their looms there in the fourteenth century. The town owes much of its early prosperity to the numerous streams from the neighbouring Pennines, which provided water-power for its mills. Thanks to these hills, the surroundings of Rochdale are much more beautiful than those of the more westerly towns.

Burnley, further north, with its manufactures of cotton and woollen goods, ropes and leather, enjoys the same advantage. Preston, beautifully situated on the Ribble, and a port in a small way; Blackburn, one of the first homes of the English cotton manufacture; Bury, Wigan, and Stockport, are other cotton towns which can only be mentioned in passing.

The Scottish cotton industry is only a fraction of that of England, and is almost confined to the Glasgow district. As the industries of Glasgow itself are only to a minor extent those we are at present considering, that great and prosperous city, the second in the kingdom, will not be described here. But one of its special lines, the manufacture of sewing threads, is far more prominent in the neighbouring town of Paisley, where it forms the staple industry, though Paisley was formerly much more widely known for its beautiful shawls, almost a vanished industry.

Sewing thread, whether cotton or linen, is much stronger than the fine yarn spun for weaving, and is in fact made by twisting several such threads together. This was a Dutch industry until, early in the eighteenth century, a widow lady living near Paisley obtained a hand machine and began to make linen thread for her living. The work was taken up by others, including two brothers named Clark and two others named Coats, who started in a small way, but whose businesses grew into enormous concerns which were combined not many years ago.

Clark's Mills, Paisley

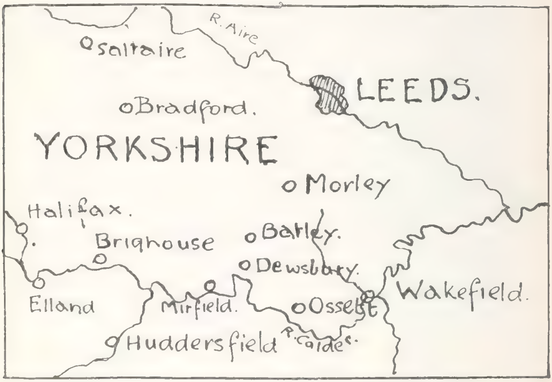
Their mills in Paisley now employ over 10,000 workers, mostly girls, and supply the greater part of the world with linen and cotton sewing thread. The thread used to be sold in hanks, but the original James Clark got a wood turner to make wooden bobbins on which he wound the thread for his customers, charging a halfpenny, which was returned when the empty bobbin was brought back.

At the great works in Paisley huge stacks of timber are cut up and made into millions of bobbins, or reels; the bales of raw cotton are made into thread, which is measured and wound on the bobbins; the bobbins are counted and have the labels stuck on the ends; and all this is done by thousands of ingenious machines. The town itself, with its fine town hall and other public buildings, parks, and open spaces, is a very prosperous one. It stands on the river Cart, which flows into the Clyde three miles away, and has several ship-building yards.

13. GREAT MANUFACTURING TOWNS. II

Two centuries ago, Leeds, which is described in Domesday Book as a thriving village, was a small market-town with a cloth hall, in which on two days in the week the pieces of cloth made in the town and surrounding villages were offered for sale. A few years before, in all weathers, the market was held on the bridge over the Aire, the pieces being laid out on the stones, or on stalls.

To-day it is the sixth city in size in the United Kingdom, and the first in Yorkshire, with a population of nearly half a million. Although the woollen and worsted trades are its chief industries, it has many others of great importance, and to this fact the city owes its prosperity. Great tanneries, iron-works, and breweries are to be found in different quarters; there is an enormous manufacture of ready-made clothing and caps; boots and shoes, machinery and engines, canvas and ropes are among its products, while there are also many glass-works and dye-works.



The Woollen District

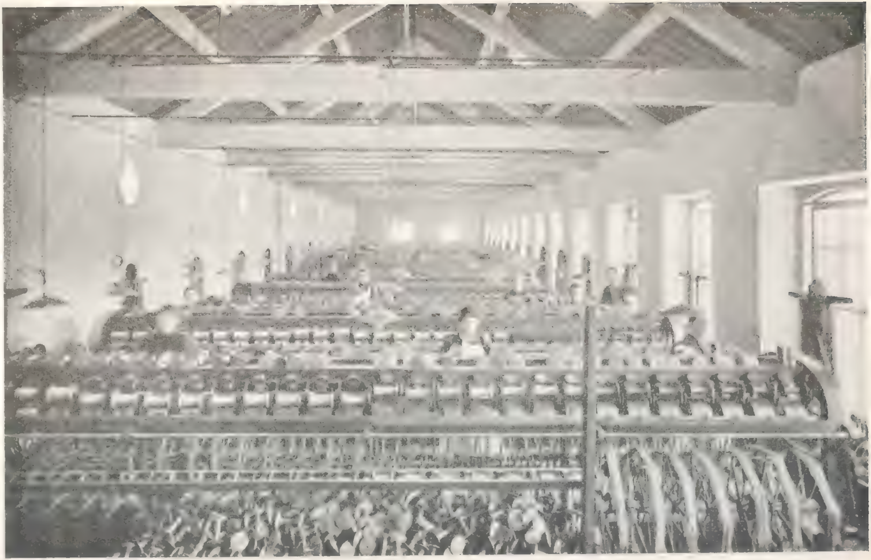
The Town Hall is a magnificent building, and its great hall contains one of the finest organs in England. The Yorkshire College forms part of the Victoria University, and the Central Higher Grade School is one of the best in the country. Among the other fine public institutions are the Municipal Buildings, the Art Gallery, and the Public Library.

Bradford, though not so large as Leeds, is the greatest wool-working city in the world. Wool-combing and the manufacture of worsted cloth, with woollen cloth to a much less extent, and cashmeres, merinos, and other dress goods for women's wear, are its chief lines. Large quantities of yarn are sent to other towns to be woven—for example, into carpets at Kidderminster, and into hosiery at Nottingham

Cotton-mills, dye-houses, and machine-shops are other features of Bradford, and Lister's silk-works, in the suburb of Manningham, are the largest in the world. At its great iron foundries the ore from the iron-mines of the district is smelted. At the model town of Saltaire, three miles away, are the fine factories founded by Sir Titus Salt, who introduced the alpaca trade. Five thousand people are employed in them.

The city of Belfast, which had 387,000 inhabitants at the census of 1911, is larger than the two next largest Irish cities, Dublin and Cork, together. It stands on the river Lagan, and is the capital of the province of Ulster, as well as being the centre of the Irish linen industry. An enormous quantity of flax, grown in the surrounding counties and imported from abroad, is spun and woven in the city, while the linen yarns exported are valued at over £1,000,000 annually.

Distilling is another important industry, and the city has the largest rope-works and the largest tobacco factory in the world. It is one of our most important ship-building centres, some of the largest liners in the world having been built there for the White Star Line. No other city in Ireland compares with it in the extent and variety of its industries, though Dublin (305,000) approaches it in size, and is, of course, the Irish capital.



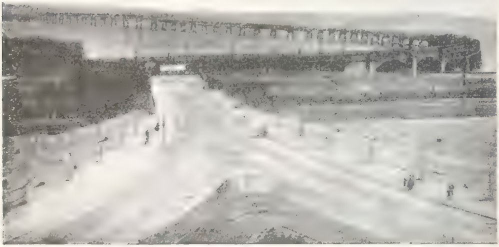
Warp and Woof Winding room, Belfast

Its harbour and docks are amongst the finest in the kingdom, and the city itself has been greatly improved during recent years. Among the many handsome buildings are the City Hall, the Cathedral, the Campbell College, with a Public Library, hospitals, museum, and other public institutions usually found in a large and prosperous city. The water supply, like that of Manchester, Liverpool, and other large towns, is brought from a distance, in this case from the Mourne Mountains, 40 miles away. Belfast has a large foreign trade, besides that with Great Britain.

Dundee, on the north shore of the Firth of Tay, is the chief centre of the linen manufacture of Great Britain, though much inferior in importance to Belfast. But much more important than this industry is the manufacture of jute, enormous quantities of which are imported from India. Hemp is also manufactured here. All kinds of sail-cloth and other canvas, sheetings, bagging, and jute carpeting are produced in the mills of Dundee, the linen and jute being turned out as cloth, bags and sacks, or as yarn.

The bridge which carries the railway over the Firth of Tay is a wonderful piece of engineering. It is over two miles in length, and the rails are 92 feet above high-water at the part under which the river traffic passes. The town has also busy docks and ship-building yards, and some of its ships are engaged in the Arctic seal and whale fisheries. Other industries are engineering, tanning, and the making of leather goods, while Dundee marmalade is familiar to everybody.

Few British towns have had a more troublous history than Dundee. It has undergone many sieges, and in one of these it was taken by storm by General Monk, in 1651, when one-sixth of its people and garrison probably perished in the sack which followed. Sixty ships sailed away with the plunder, but are said to have perished in a storm within sight of the town. It was here that Wallace struck his first blow for Scottish freedom, and later it was connected with the noted Graham of Claverhouse, who became Viscount Dundee, the "Bonnie Dundee" of the old Scottish song.



The Tay Bridge

The fine Midland city of Nottingham has been an important town for over a thousand years, and had a population of 260,000 in 1911. It is served by four of the great railway systems, and has water communication by the Trent and two canals. Its handsome public buildings include the Castle, the Guildhall, City Sessions Court, University College, several beautiful churches, and various public offices. Across its market-place, one of the largest in the kingdom, a wall was built after the Conquest, to separate the Norman from the Saxon part.

Nottingham is the great centre of the machine-lace, and the cotton, silk, and merino hosiery trades, just as Leicester is the centre of the manufacture of woollen hosiery. Other important industries are bleaching, the dyeing, spinning, and twisting of silk, the spinning of cotton and woollen yarn, and cycle making. Nottingham Castle played a prominent part in history. Several parliaments were held in it in the fourteenth century, it was the headquarters of Richard III just before the battle of Bosworth, and Charles I began the Civil War by raising his standard here.

14. TRADE UNIONS AND STRIKES

There is an old proverb which tells us that "Union is Strength," and few more striking examples of its truth could be given than the history of the trade union movement. There have been many unions of workers, of various kinds, in the past, but trade unions in the modern sense are the outcome of the industrial revolution. Before that time, when industry was largely in the hands of small masters, among whom a thrifty and clever workman might easily take his place, there was no real trade unionism.

When manufactures could be successfully carried on only in special buildings, with expensive machinery, wealth and power passed into the hands of the employers, and the workmen found themselves more and more at their mercy. They therefore, naturally, began to combine for their own protection. At first the movement was chiefly in the direction of friendly societies, in which the members paid regular subscriptions, thus creating a fund from which those overtaken by sickness, unemployment, or bereavement, might be assisted.

There are now many such societies, some with many thousands of members, but the object of trade unions proper is not only the protection of its members, in these and other ways, but also the improvement of the conditions of labour. Thus the Yorkshire wool-combers, the Midland stocking framework-knitters, and other associations, soon began to band together to secure good wages.

The trade union movement, like the industrial system itself, rapidly spread to other countries, though in some of them the movement has been far more marked by illegal and violent methods than has ever been the case in Britain.

There was, indeed, great need for such combination. The hours of labour were in many cases quite excessive, the lowness of wages paid made it a constant struggle to live, and the conditions under which work had to be carried on were too often injurious to health and dangerous to life. Yet the unions were looked upon with suspicion and dislike, and as the interests of the wealthy were far better represented in parliament than those of the working classes, laws were passed in 1800 making them illegal.

These Combination Laws, as they were called, were very unjust to the workers, who strongly resented them, and many secret associations were formed, some of them encouraging acts of violence. However, in 1824 the laws were repealed, and trade unions sprang up all over the country. They began at once to demand higher wages, and numerous strikes took place to compel the employers to grant them.

The latter, greatly alarmed, tried to secure fresh acts of parliament to put an end to all workers' societies, but failed. Though the shipping trade of the north-east coast had been almost brought to a standstill by the strikes, an act was passed in 1825 recognising trade unions and the right to strike, although combinations for unlawful objects were forbidden.

Since that time strikes have constantly occurred in various trades in different parts of the country. The strike, indeed, is the final and most powerful weapon of labour. For the employer it means that his business is brought to a standstill. He is unable to fulfil his contracts, and not only do his profits cease, but heavy expenses, such as rent and interest on capital, have to be met, his *plant* (machinery, etc.) may be injured by lying idle, his customers may be transferring their business to his rivals, and he may be injured in other ways.

To the worker, on the other hand, it means loss of wages. He has an allowance from the funds of his union—strike pay, as it is called—but this is much less, as a rule, than his usual wage, and he may have saved up money upon which he can fall back, though this is not often the case. The union funds gradually diminish—these of course being the savings of the workers—and even if helped by grants from other unions in sympathy with the strike, at last disappear if the strike lasts for a long time.

Then the strikers may be forced, by the privations suffered by themselves, their wives and children, to submit to the terms of the employer. Even if the strike is successful, the workers have suffered great loss, and their union is weakened by the decrease of the funds. It will thus be seen that a strike, whatever its result, may inflict very serious losses on both sides, and it is to the interest of both parties to avoid it if possible. If both feel that the point in dispute is too serious to yield without a struggle, it becomes a question as to which can hold out longest.

Employers, of course, combine, as well as workers, and there are many such unions, or federations, among them. Just as the men may threaten a strike to enforce their demands, the employers may use the threat of a "lock-out." If this is resorted to all the works in a given trade in a particular district are closed, and the men thrown on the funds of their union. In this case also loss is inflicted on both sides until the dispute is settled.

Not only are there hundreds of individual unions, but these are combined in various federations. The General Federation of Trade Unions has over 700,000 members, and the Miners' Federation over half a million. Every year a Trade Union Congress is held, attended by delegates who discuss points of importance to the workers, and vote on behalf of the members they represent. The business of the unions and federations is carried on by executive committees, which, under the control of the associations, exercise great powers.

Employers and workers are not the only people who have an interest in strikes. The interests of the general public are sometimes very seriously affected. A great coal strike, by sending up the price of coal, inflicts hardship on large numbers of people who have nothing to do with the dispute. A railway strike may similarly cause loss and inconvenience to thousands who depend on the railways for their supplies of goods, as well as for travelling; and so in many other directions.

These things actually happen, and it is realised that a great strike is a serious national concern. It is therefore generally avoided unless the leaders of the workers feel that they will have the sympathy of the public in their demands. Of late years, too, disputes have frequently been settled by arbitration, so that the people at large may not suffer in this way, each side agreeing to accept the decision of the arbitrator, before whom they respectively lay the arguments in their favour. Boards of arbitration have even been formed, so that disputes may be settled without threats of either strike or lock-out, and we may hope that in these matters, as in disputes between nations, this method may be largely extended in the future.

15. HOW THE STATE PROTECTS THE WORKERS

Much has been done by the workers themselves to protect their interests and to improve their condition, especially by means of trade unions and friendly societies, but much has been done also by the state. Each of these forms of interference has its own drawbacks. The trade unions, for example, are concerned solely with the interests of their members, and their demands, like those of employers, have sometimes been unreasonable. It is not always easy for one party in a dispute to take a just view of the position and claims of the other.

Moreover, a great many workers, especially children and women, are not represented by any union. There are general conditions, too, with which trade unions are hardly in a position to deal. On the other hand, too much state interference is undoubtedly an evil. There are forms of work, for instance, which every one feels are not suitable for women, and which we do not like to see them doing, but to forbid them by law would mean in some cases to deprive the women of their only means of livelihood.

Still, where the conditions are such that the general welfare of the nation suffers, and the people concerned are unable to help themselves, it is the duty of the state to interfere. The state now does interfere, for the old "go-as-you-please" policy has been definitely abandoned. A little over a century ago the conditions of factory life had become so bad, especially for women and children, that Sir Robert Peel, who was himself a cotton-spinner, secured an act of parliament by which child apprentices were to work not more than twelve hours a day, with no night-work, and were to be taught reading, writing, and arithmetic. The factories were to be well ventilated, and to be whitewashed once a year.

Inspectors were appointed to see that the law was carried out, and employers were fined if they neglected to obey it. But as many of the children were not apprenticed, the results were disappointing. A later act, forbidding the employment of children under nine, failed because no inspectors were appointed to see that it was obeyed. In 1833 another was passed, and enforced, by which children between nine and thirteen were not to work more than nine hours, and a few years later it was forbidden to employ women and children in mines.

Many other laws have been passed since, reducing the hours of labour, and ensuring that children especially should spend less time at work, and that they should receive regular education. The Factory Acts insist that cleanliness and ventilation shall be secured in factories and workshops, that proper meal-times shall be allowed, that the workers shall not be overcrowded, that dangerous machinery shall be fenced in as far as possible, with many other points, all important to health and well-being, while both men and women inspectors are employed to see that the rules are carried out.

It must be borne in mind that not only the factories in the great industrial districts, but the numberless workshops in all our towns and villages are all under government supervision, and must obey the regulations laid down by law. The result of this legislation has been of great benefit to the nation at large. The boys and girls of one generation become the parents of the next, and unless care is taken that they have a chance to grow up strong and healthy the vigour and ability of the nation are bound to suffer.

Life in crowded cities is not an ideal one, even at its best, and one has only to visit some of the working-class quarters in them, with their rows upon rows of small houses, with no gardens, to realise what the dwellers in them lose. Something has been done, by making parks and open spaces, to give them better air and pleasanter surroundings, but much remains to be done. Some enlightened employers have even built model towns, with open spaces, trees, and gardens, while the health and comfort of their work-people are equally studied in the works.

One danger to which the workers in many industries are constantly subject is the risk of accident. We read from time to time in the newspapers of explosions in coal-mines, by which many are killed, and others maimed for life. In this work, as in quarrying, falls of rock and other substances often cause death and injury. Many railway workers have to be constantly on the alert to avoid accident. Others have to work at a great height, where a slip may mean a dangerous fall. In the industries we are especially considering, a hand or arm may easily be caught in powerful and swiftly-moving machinery.

Until recent years workers had to take the risk of such accidents, and when they occurred had nothing to rely upon but such provision as they might have made in their unions and societies, if they belonged to such, or the generosity of their employers or the public. Otherwise they became a burden on their friends, or went to the workhouse.

Bournville

But in 1880 the Employers' Liability Act was passed, which threw upon employers the duty of providing for those made incapable of working, either for a time or altogether, by accident. This applied only to certain trades at first, but it has since been extended. Of course a serious accident, involving a number of people, might easily ruin a small employer, but the difficulty was got over, as in the case of many other risks, by insurance.

When people insure against fire, loss of property, accident, and so on, the small and regular payments of all the insured create a fund, which is increased by investment at interest, by which those who are overtaken by these misfortunes are compensated, and so serious loss and perhaps total ruin are averted. When an accident at work does happen, the injured person makes a claim against his employer, the amount to be paid as compensation is decided, usually in court, and the insurance company pays the money.

One result of the act was to make employers more anxious to avoid accidents. Much ingenuity has been used, not only to fence in securely the dangerous parts of machinery (this indeed is insisted on by law, and watched by the factory inspectors), but to invent new machinery. Some dangerous operations which were formerly carried out by work-people are now performed by mechanical means.

16. PROVISION FOR SICKNESS AND UNEMPLOYMENT

The wages of a working man are not, as a rule, sufficiently large to enable him to make much provision for himself and his family in case a long illness should make him unable to work, or for his family in case of his death. In any case, these disasters might come early in his career, before he had time to provide against them, except in the manner which has been already mentioned, that is, by joining some society for mutual help. This all thrifty and provident people have long been in the habit of doing.

The Friendly Societies already referred to form a very important feature of our national life, and their object is to help their members and those dependent on them in case of sickness and death. In some of these the local branches manage their own affairs to a large extent, but are combined into what are known as Affiliated Orders. There are about 100 of these affiliated orders, with over 20,000 branches, and the total number of members, according to a recent return, was about 2,700,000.

Their total funds amounted to about £26,000,000. The best known is the Manchester Unity of the Independent Order of Oddfellows, which in one year pays over £1,000,000 to sick members, or to the families of members on the death of the latter. The Ancient Order of Foresters is almost as large, and the Sons of Temperance is another important one. Most, of course, are much smaller, but they are generally well managed and sound.

We can imagine what an enormous amount of help in time of need these societies represent, and how many people are cheered and encouraged by the reflection that if trouble comes they will be at any rate spared the bitterness of absolute poverty.

The branches of these societies hold regular meetings, at which, when the business is done, enjoyment becomes the order of the evening. There are, however, General Societies, which have no such meetings, but are carried on as purely business concerns, like mutual Insurance

Companies, which is practically what they are. The Hearts of Oak is a well-known example of this class of society.

Less important, though very common, are the Sharing Societies, Slate Clubs, and so on, which have the same objects, but in which what is left of the amount paid in during the year, after the claims have been paid, is shared out among the members, usually about Christmas. These have not the security of the Friendly Societies, with their substantial balances. Burial Clubs are another form of provision for the expense entailed by a death.

A large proportion of the working class, however, as of other classes, are deficient in prudence and foresight, and there are many for whom friendly societies, trade unions, and so forth, are not available, or who, for other reasons, are unable to join them. Much distress, for which no provision had been made, was caused when these were overtaken by sickness or death, and at length the government intervened, and, for the first time, made thrift compulsory.

In 1912 the National Health Insurance Act came into operation, affecting, with certain exceptions, all employed persons in the United Kingdom whose income does not exceed £160 per annum. Free medical treatment and a weekly allowance in case of sickness are provided, but the burden of paying for these benefits is divided between the employer, the insured person, and the government.

Each worker has a card, upon which the employer is bound by the act to affix each week a 7*d*. stamp in the case of a man, or a 6*d*. stamp in the case of a woman. He is, however, entitled to retain from the wages of the employed person 4*d*. or 3*d*. each week, according as the person is a man or a woman. If the wages are less than 2s. a day the sums are less than these. The benefits provided by the state are greater than could be assured by the payments of the employer and the worker.

The great bulk of the work involved is done not directly by the government, but through "approved societies" such as most of the friendly societies and a number of the insurance companies, the insured being allowed to choose which he shall join. The total number of insured persons at the end of 1913 was nearly 14 millions.

The state insurance scheme also includes unemployment, but is confined to a limited number of trades, chiefly connected with building and engineering. It is worked largely through the Labour Exchanges. These are offices established in the towns of the United Kingdom by which the state, through the Board of Trade, does a good deal to lessen unemployment.

At these offices men and women in need of work give in their names, stating the kind of work they want, and employers in need of workers also send particulars of the vacancies they have. The exchanges then do their best to bring the two together, and as the offices are all in communication with one another, the workers have all possible opportunities of finding employment. Of course the scheme cannot make work, but the help it gives is of great service to the unemployed, and also to employers. In 1912, 680,000 persons obtained engagements of over a week, besides a very large number who obtained jobs of shorter duration.

17. CARE OF THE POOR, THE AGED, AND THE SICK

The treatment of the poor has always been one of the pressing problems of civilised nations, and our own history records many attempts to deal with it. During many centuries it was regarded as the duty of the Church. A large amount of wealth, partly bestowed in the form of gifts and bequests by the wealthy, or the offerings of the people, came into her hands. Much of this was employed in providing food for the poor, and helping them in other ways.

Sometimes the number of poor and unemployed so increased that serious trouble arose. After a war, for example, the disbanded soldiers were often without means of support, and numbers of them turned robbers, infesting the woods and wastes with which the country was largely covered, while they robbed, and often killed, unfortunate travellers who fell into their hands. Sometimes the sufferings of the poor led to rebellions, such as those under Wat Tyler, Ket the tanner, and Jack Cade.

Many hospitals and other refuges for the aged and for children were also founded by generous people in the olden days. Licenses to beg were freely granted, and the number of "sturdy beggars," who might in many cases have worked if they had been willing, became at times a public danger. Then laws were passed making the various parishes or other districts responsible for their own poor, and some of them compelling people to contribute according to their means. Under Elizabeth more serious attempts to provide for the poor were made than ever before.

Many laws have since been passed, some wise and helpful, others leading to unforeseen abuses. As time went on, abuses were corrected and hardships removed, and so, as the result of experience and many experiments, our present Poor Law system has grown up. A Royal Commission in 1832 enquired into the action of the existing Poor Laws, and great changes were made by parliament, introducing the principles which still govern the methods employed in dealing with the poor.

Before that time men whose wages were insufficient to keep them were allowed "out-door relief," and the farmers especially took advantage of this to pay very low wages, so as to throw part of the burden they ought to have borne on the parish. This did great injury to the manliness and self-respect of the labourers, and was very properly ended. No out-door relief was henceforth to be granted to any able-bodied pauper.

The care of the poor has long been entrusted to guardians and overseers, who have administered the public funds set aside for the purpose, and since 1894 the guardians have been directly elected by the public to carry out the work in the 653 "poor law unions" into which England, with Wales, is divided. The necessary funds are raised each half-year by rates levied by the local authorities, the land and buildings in the union being assessed at a certain value, and the rate demanded being so much in the pound of this assessment.

The duty of the guardians is to provide for paupers, either by an allowance paid to them in their own homes or by maintaining them in poor-houses or workhouses built for the purpose. Infirmaries are also provided for the sick, and asylums for the insane, among them. In casual wards people wandering in search of work may receive food and lodging for a night or longer, being required, as a rule, to do a certain amount of work, such as stone-breaking, in return. The annual cost of poor relief in the United Kingdom is over £17,000,000.

Many deserving poor are very reluctant to accept relief, and have a great dread of having to go to the workhouse when no longer able to earn a living. It is very sad when a person with such a feeling, after a long and industrious life, is obliged by the weakness of age to seek this refuge. The passing of the Old Age Pensions Act in 1908 was therefore a wise and humane step on the part of the government, and brought happiness to thousands of poor old people.

By this act a man or woman over 70 years of age, who is a British subject, and has resided for a certain period in the United Kingdom, is entitled to a weekly pension, if his or her means do not exceed £31. 10*s.* a year. Criminals, lunatics, and people who, through idleness, have failed to support themselves, are excluded from this benefit. If the yearly income does not exceed £21. 4*s.* the full pension of 5*s.* a week is allowed, with smaller sums if the income is between that amount and the limit mentioned above.

The cost to the country is, of course, very great, and it is only this fact which prevents the age limit from being lower, but it is a source of satisfaction to know that nearly a million aged men and women in the United Kingdom are thus being helped to spend their remaining years in comfort, and in their own homes or with friends.

We must not leave unnoticed the magnificent work done by our Hospitals and Dispensaries. Serious cases of disease and accident are constantly occurring, which call for medical and surgical skill, the cost of which would be far beyond the means of the poorer classes. But in all our large cities and towns, and in many smaller ones, hospitals have been built, in which those who are unable to obtain the necessary treatment for themselves may be cared for.

The wards are spacious and airy, everything is spotlessly clean, trained nurses move quietly about with cheerful smile and ready hands, doing all that can be done for the comfort and happiness of the patients. Some of the most skilful physicians and surgeons give their services freely, and all the appliances which modern science can suggest, some of which are very costly, are provided and used. In many cases patients, when sufficiently well, are sent off to convalescent homes to complete their recovery.

At the dispensaries "out-patients," whose ailments are not so serious as to make it necessary for them to be treated in the hospital, obtain free advice and medicine. Many homes, too, have been built for cripples and people with incurable diseases, lightening their burden by ensuring comfort and security. Some hospitals are entirely for children, for whom, too, special wards are set apart in others. This work, one of the most admirable forms of benevolence, has been carried on for generations, and is supported in various ways.

Many hospitals have endowments, that is, sums which have been given for investment, the interest from which forms a regular source of income. Many generous people give annual subscriptions, or single donations, and large sums come from the working classes in small amounts. Annual collections are made in London and throughout the country for the hospitals, very valuable help being obtained in this way.

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